THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper]

Vol. XXXIV. No. 865.] LONDON, DECEMBER 9, 1879. [31st Year.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
Several Prize Medals. Established over 20 Years.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
Proprietors: STEVENS & CO.,
11, GREAT WINCHESTER STREET, LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
Manufacturers of
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
Head London Office:
145, QUEEN VICTORIA STREET.
ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNT'S
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE.

See Page 886.

CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

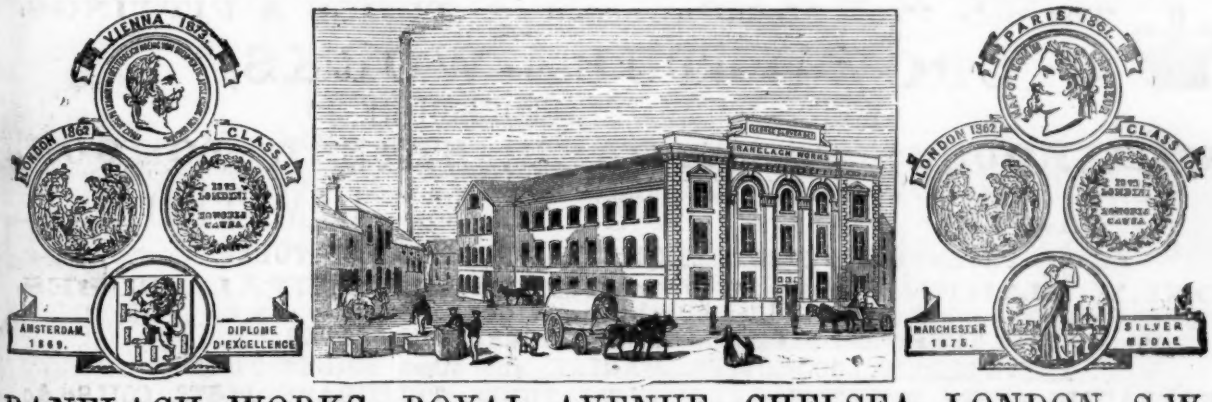
THE
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.

AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.
ESTABLISHED 1840.

CHANGE OF ADDRESS.

GEORGE GLOVER AND CO.,

DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:



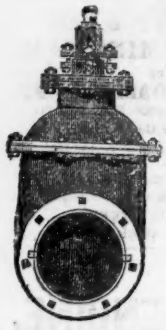
RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

WELLINGTON TUBE WORKS,

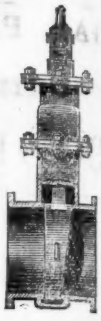
GREAT BRIDGE, TIPTON, STAFFORDSHIRE.

JOSEPH AIRD,

GAS, STEAM, AND HYDRAULIC TUBES AND FITTINGS.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

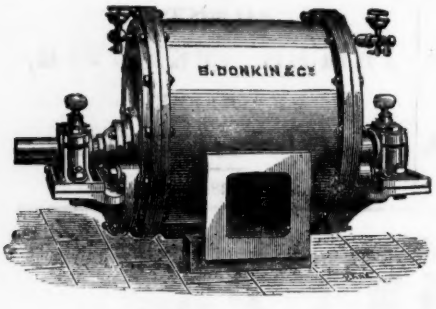
Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.



J. BEALE'S

NEW PATENT GAS-EXHAUSTERS,

For the Manufacture of which

MESSRS. B. DONKIN & Co.

POSSESS THE SOLE RIGHT.

Made with two Outside Bearings and with all the Latest Improvements.

FULL PARTICULARS ON APPLICATION.

BERMONDSEY, LONDON, S.E.

Messrs. B. D. & Co. are also Manufacturers of Steam-Engines and of Improved Gas and Water Valves, &c., &c.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c,

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

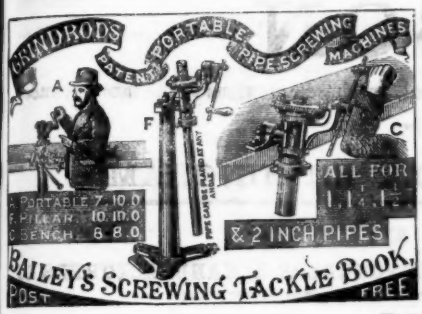
SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

LONDON OFFICES: 97, CANNON STREET—JAMES E. & SAMUEL SPENCER, AGENTS.



BAILEY'S FLY WHEEL STEAM PUMPS
SIMPLE & STRONG.
WITH No MYSTERIOUS VALVES.
W. H. BAILEY & Co. HYDRAULIC ENGINEERS
ALBION WORKS, SALFORD, MANCHESTER.

Prices of Bailey's Double-Acting Steam-Pumps

No.	Diameter of Steam Cylinder.	Diameter of Pump.	Length of Stroke.	Gallons per Hour. Approx.	Price.
	Inches.	Inches.	Inches.	At Slow Speed.	£
A 1	4	2	6	850	18
B 2	6	3	10	1,940	25
C 3	6	4	10	2,000	30
D 4	8	4	10	3,150	40
E 5	6	6	10	7,200	40
F 6	8	6	10	7,200	50
G 7	10	6	12	7,200	60
H 8	8	8	10	14,000	65
I 9	10	8	12	14,000	75
K 10	12	8	15	14,500	90
	10	10	15	21,000	110
	12	10	15	21,000	125

NOTE.—*At quick speed these pumps will generally deliver double the quantity specified.*

BAILEY'S HOT-AIR ENGINES,

From ¼-horse to 4-horse Power. Particulars on application. We also make Hot-Air Pumping Engines, and every description of Hydraulic Work.

W. H. BAILEY & CO., ALBION WORKS, SALFORD, MANCHESTER.

LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It has been in successful constant use for nearly three years, does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention.

For Particulars and Prices apply to

Messrs. DEMPSTER AND SONS, ELLAND, HALIFAX, for the North;

Messrs. BAILEY, PEGG, AND CO., Bankside, LONDON, S.E., for the South;

Messrs. WILLEY AND CO., Commercial Road, EXETER, for West of England and South Wales;

Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION

BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

HONOURABLE MENTION.

J. E. WILLIAMS & CO.,

PARIS EXHIBITION, 1878.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

G. J. EVESON

Has on Sale a large quantity of Cannel, South Yorkshire, Wigan, and Ruabon Coal, purchased previous to the late advances.

Prices on Application.

GAS COAL AND CANNEL CONTRACTOR, BIRMINGHAM.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & Sons undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM;

AND 85, SOUTHWARK ST., LONDON, S.E.

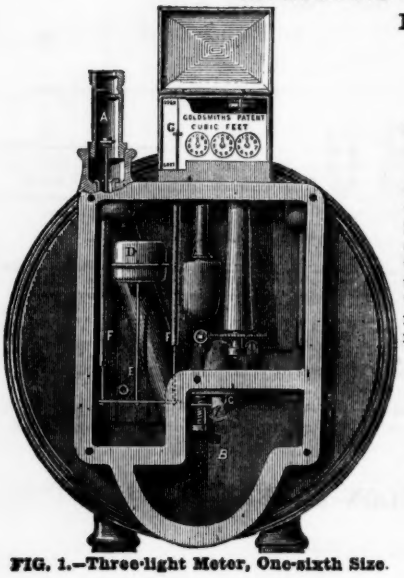


FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

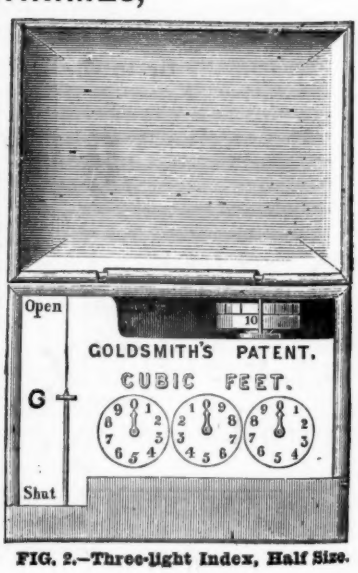
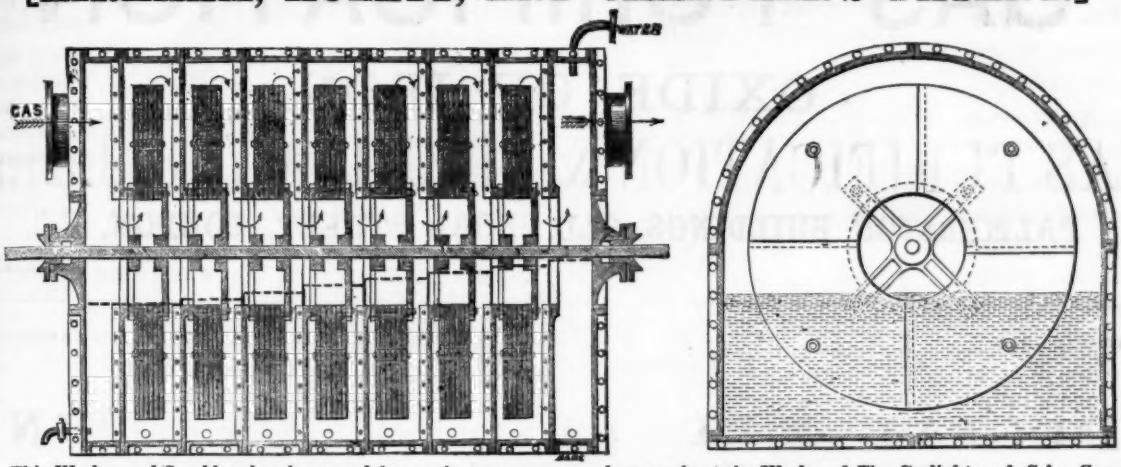


FIG. 2.—Three-light Index, Half Size.

THE

"STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]



This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

D. HULETT, Esq. *The Gaslight and Coke Company, Bromley-by-Bow, May 3, 1877.*

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Leeds Corporation Gas-Works, York Street, Leeds, Dec. 6, 1878.*

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber,** so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan. 14, 1879.*

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia,** while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c. (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6¾	5	3½	2½	1½	¾	½	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
,, 2	8¾	7	6	4½	3¼	2½	1½	¾	½	0	10 ,,	57,000	Nil.	73°	66°	32°	21¾	20½	4
,, 3	9½	8	6	3¾	3	2½	1½	¾	½	0	10 ,,	60,000	Nil.	75°	68°	40°	23½	22	4
,, 4	9¼	7¾	6¼	4¼	3¼	2¼	1¼	¾	¼	0	10 ,,	65,000	Nil.	74°	68°	33°	24	22½	5
,, 5	9½	7	6	4	3	2½	1¼	1	¼	0	10 ,,	34,000	Nil.	77°	68°	35°	14½	14	5
,, 6	9¼	7¼	6½	4¼	3	2¼	1½	1	¼	0	10 ,,	63,000	Nil.	72°	66°	27°	24	22½	4½
,, 7	11	9	7	5½	3¾	3	1¾	1½	½	0	10 ,,	59,000	Nil.	74°	66°	31°	25	23½	5
,, 8	9½	7½	6	4½	3	2	1	¼	¼	0	10 ,,	78,000	Nil.	73°	61°	31°	28	26½	4½
,, 9	11	9	7	5	3¾	2½	¾	1	¼	0	10 ,,	82,000	Nil.	74°	67°	33°	27½	25½	5
,, 10	10¾	8½	6¾	5	3½	2¼	¾	1	¼	0	10 ,,	66,000	Nil.	76°	64°	28°	28½	27	5
,, 11	12½	10	7¾	5¾	4½	3½	1¼	1¼	½	0	10 ,,	61,000	Nil.	78°	64°	27°	26½	25½	5
,, 12	11	8¾	6¾	—	—	—	1¼	¾	¼	0	10 ,,	39,000	Nil.	74°	64°	27°	26½	25½	5
,, 13	13	10¾	8¼	6	4¾	3½	2	1¼	½	0	10 ,,	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May 23, 1879.*

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March 6, 1879.*

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				—	—	—	—	—	—	—	—	—	—	
64,000	Inlet	2·00	2·00	158·8	72	57	21	4½	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·05	0·6	0·3	0·15	0·1	63
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

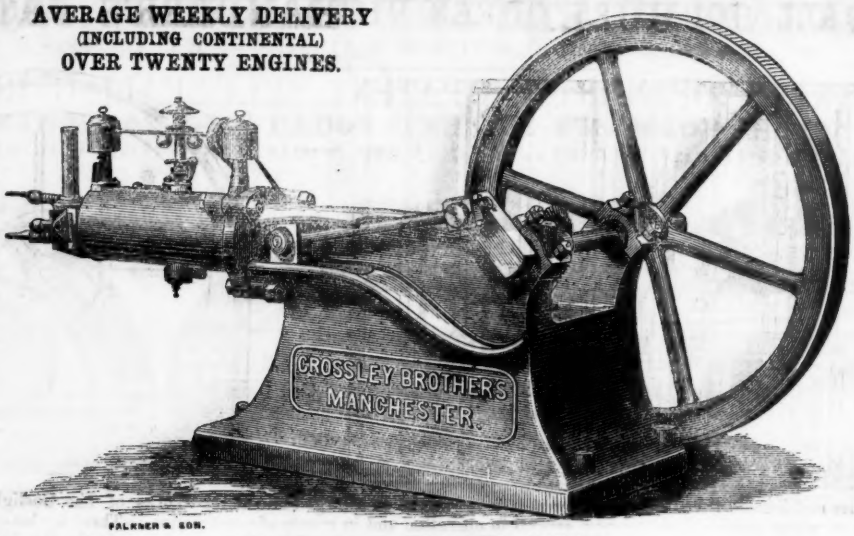
For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



PALMER & SON.

Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. **SIZES** { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } **OFFERED.** CASES NOT CHARGED IF RETURNED FREE.

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES)

WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St. **CROSSLEY BROTHERS,** MANCHESTER. LONDON HOUSE: 116, Queen Victoria St., E.C.

THE NEW GAS COOKER.

40 PER CENT. OF GAS SAVED.

No. A510 same as our **No. A152,**
BUT LINED WITH PATENT NON-CONDUCTOR.
Will Roast, Bake, and Fry, and with Three Burners for Boiling.

SIZE.
Outside—30in. high, 20in. wide, 20in. deep.
Inside—19½in. „ 14in. „ 17in. „
Price . . . . . £4 14s. 6d.

No. A500.
LINED WITH PATENT NON-CONDUCTOR.
Is fitted with Roasting and Baking Oven and Four Burners for Boiling.

SIZE.
Outside—34in high, 20in. wide, 19in. deep.
Inside—30in. „ 16in. „ 17in. „
Hot Plate—24in. by 23in.
Price . . . . . £7 10s. 0d.

No. A505.
Same as with Roasting and Baking Oven, a Broiler or Toaster, a Chop Griller, a Hot Water Boiler, and Three Burners for Boiling.
Hot Plate—26in. by 24in.
Price . . . . . £9 15s. 0d.

These Cookers are jacketed, on the sides, top, and door, with a new and very efficient non-conducting material, by the use of which a **saving** of gas to the extent of **40 per cent.** is effected.

Gas Companies who are selling or hiring stoves should see these stoves. Catalogues and particulars on application to

JOHN WRIGHT & CO., ESSEX WORKS, BROAD STREET, BIRMINGHAM.

London Warehouses: { 155a, Upper Thames Street, / 1, Little Bush Lane.

TANGYE BROTHERS AND HOLMAN,

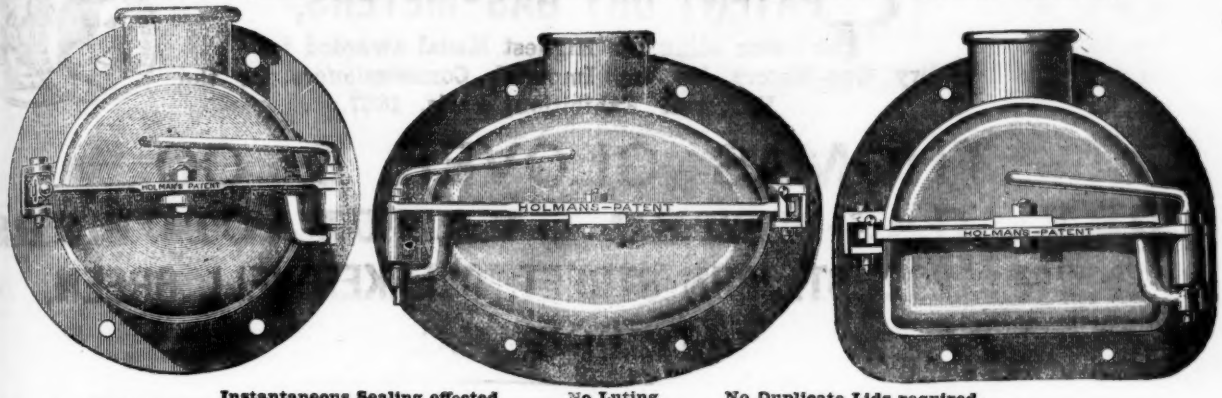
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. T. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

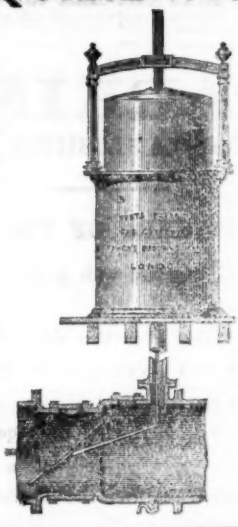
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hurt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

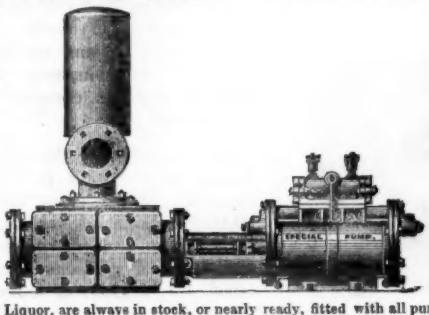
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	21
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

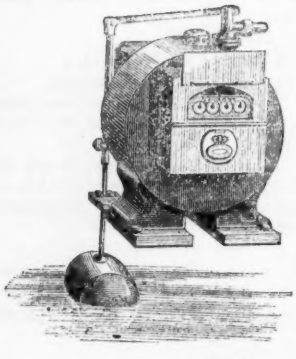
LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.

(ESTABLISHED 1816.)



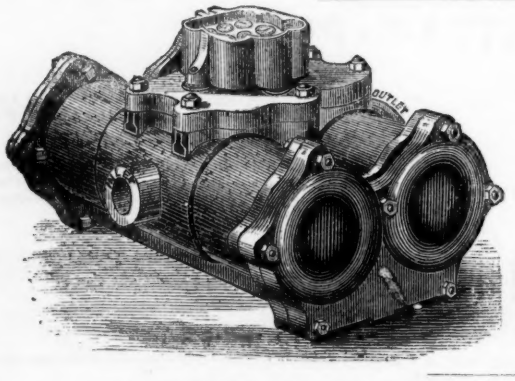
SOLE MAKERS OF THE LOW-PRESSURE WATER-METER.

This Meter will register with perfect accuracy, either at full speed, or with a few drops only passing through it.

It must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below.

Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



HIGH-PRESSURE WATER-METER.

The Union Water-Meter, of which an external view is here given, is of the positive class—*i.e.*, a Meter in which a measuring chamber is alternately filled and emptied, each filling being duly recorded. It is formed of two cylinders, with double pistons in each, having a rotary-valve of peculiar construction, which is worked from cams on the piston-rods.

It is claimed for this Meter, among its advantages over other Piston Meters in use, that it is extremely small and compact, and that its durability and accuracy have been proved by the fact that upwards of 20,000 of them, of various sizes, are in successful operation in the States. In England the instrument has been fully tested by several Water Engineers of eminence, and pronounced by them as a reliable and satisfactory register of water supply; it is also economical in cost.

ALL METERS are TESTED with 60 lbs. pressure before they are sent out.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

CONTENTS.

Circular to Gas Companies:— PAGE
The Proposed Amendment of the Chartered, Commercial and South Metropolitan Gas Acts . . . 889
Improved Railway Carriage Lighting . . . 889
Reduction in the Price of Gas by the Chartered Gas Company . . . 890
The Electric Light and Gas Affairs at Hull . . . 890
An Experiment with the Electric Light at Woolwich . . . 890
The New Gas-Works of the Leicester Corporation . . . 890
Appropriation of Gas Profits at Rotherham . . . 890
The Meeting of the Manchester Institution of Gas Engineers . . . 890
Water and Sanitary Notes:—
The Report of the Southwark and Vauxhall Water Company . . . 890
The Quality of the Metropolitan Water Supply during November . . . 891
Opposition to the Water Scheme of the Liverpool Corporation . . . 891
Leading Article:—
The Action of Coke Slag upon Fireproof Materials . . . 891
Communicated Article:—
The Corrosion of Iron. By Mr. William Foster, M.A. . . . 893
Correspondence:—
The Removal of Tar from the Hydraulic Main . . . 894
Legal Intelligence:—
High Court of Justice—
Chancery Division—Attorney-General *v.* Corporation of Barnsley . . . 894
Queen's Bench Division—Hawkesley *v.* Bradshaw and Another . . . 894
Miscellaneous News:—
Gas for Railway Carriage Lighting . . . 892
Death of Mr. G. Buist, of Nova Scotia . . . 893
Institution of Civil Engineers . . . 893
Manchester Corporation Gas Supply . . . 893
The Recent Explosion at the Bradford Corporation Gas-Works . . . 893
Birkenhead Corporation Gas Supply . . . 894
Portishead District Water-Works Company . . . 894
Imperial Water and Gas Corporation, Limited . . . 894
Metropolis Gas Supply . . . 895
Metropolis Water Supply . . . 895
Manchester District Institution of Gas Engineers . . . 895
American Gaslight Association . . . 898
Retford Corporation Water Supply . . . 900
Extension of Storeage at the Chartered Gas Company's Works, King's Cross . . . 900
Rotherham Corporation Gas Supply . . . 900
The St. John Patent Gas Purifier . . . 901
Weights and Measures Act, 1878 . . . 901
On the Heating Power of Coal Gas of Different Qualities. By Dr. William Wallace, F.R.S. . . . 902
The Waste of Energy in the Production of Water Gas. By Mr. Eugene Vanderpool 902
Leicester Corporation New Gas Works . . . 903
Trade Reports . . . 904
Sale of Shares in the Guildford and Sheffield Gas Companies . . . 905
Reduction in the Price of Gas at Richmond (Surrey) . . . 905
Crawley Gas Company . . . 905
Extension of the Water Undertaking of the Bath Corporation . . . 905
The Corporation of Hull and the Electric Light . . . 905
The Water Supply of Tewkesbury and the Sewage Pollution of the Severn . . . 905
Wigan Corporation Water Supply . . . 905
Local Government Board Inquiry at Haworth . . . 905
Opening of the Bridgwater Corporation Water-Works . . . 905
Association of Municipal and Sanitary Engineers and Surveyors . . . 905
The Water Supply of Milton and Sittingbourne . . . 905
Darwen Corporation Gas Supply . . . 905
Liverpool Corporation (Vyrnwy) Water Scheme . . . 905
Society of Engineers . . . 906
Register of Patents:—
Arundel, G.—Water Taps . . . 906
Abel, C. D.—Stand-Pipes and other Conduits Employed in the Manufacture of Gas 906
Molison, A. R.—Lighting Gas Jets by Electricity . . . 906
Blackwell, W.—Automatic Balance Pump . . . 906
Hannoversche, Maschinenbau-Actien-Gesellschaft - Gas-Engines . . . 906
Bennett, P. D.—Purification of Coal Gas . . . 906
Clayton, S.—Gas Motor Engines . . . 907
Applications for Letters Patent . . . 907
Patents which have passed the Great Seal . . . 907
Patents which have become void . . . 907

TO CORRESPONDENTS.

R. R.—*We hope shortly to have a series of articles on the subject.*

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 9, 1879.

Circular to Gas Companies.

THE Metropolitan Board of Works have changed their minds, and have now resolved to co-operate with the Board of Trade and the Corporation of London, in endeavouring to obtain some alteration in the mode of levying penalties and forfeitures for deficiencies of illuminating power and pressure, and excess of impurities in the gas furnished by The Gaslight and Coke, Commercial, and South Metropolitan Gas Companies. Now that the Board of Trade have joined in the promotion, as we may say, of a measure, the terms of which are to be arranged at a conference of the three authorities named, something is certain to be done; but at present we only know quite vaguely what that something will be. We may take it, however, that none but small changes will be made. All recent Metropolitan gas legislation, as it now stands, is in reality the creation of the Board of Trade, who are not very likely to deviate widely from the course they have travelled. Complaints are, of course, made of insufficiency of illuminating power; and, even supposing that we had in London the highest class of cannel gas which is furnished in some of the Scottish burghs, complaints would be equally rife. The simple fact is that there is no satisfying the Metropolitan gas consumer, or rather those who pretend to represent him. The gas supplied in London at the present time is sufficient for all purposes. The illuminating power is all that can be desired, and the purity well fulfils the requirements of past Acts. Further than this, the quality of the gas is admirably adapted for consumption in cooking and heating apparatus. As regards pressure, we know perfectly well that it is maintained to an extent which is compatible with the true interests of the Companies on the one hand, and the consumers on the other. Just now we have loud complaints of excess of pressure, which is supposed by not a few to cause increased gas bills. The Gas Companies, however, are not likely to send out their gas at an excessive pressure, for they do the best they can to keep it down, so as to prevent leakage as far as possible, and thus, in effect, reduce the price of gas to consumers; for gas, whether it is used in burners or escapes into the soil beneath our feet, costs money, and in some way or other the Companies must be paid for it.

As stated above, the Metropolitan Board of Works have determined to join in what we may fairly call the persecution of the Gas Companies. It is done, however, in a half-hearted manner, as will be seen by the following motion, proposed by Mr. Runtz, and which was only carried by a majority of six in a Board of twenty-six:—"That notice having been given "by the Corporation of London of a Bill to amend the pro- "visions of certain gas Acts relative to the testing of gas, so "as to enable the gas to be tested in the districts in which it "is consumed, and the Board of Trade having, in reply to a "suggestion from this Board, promised to assist the Corpo- "ration and the Board in their action, it be referred to the "Parliamentary Committee to confer with the Corporation "and to arrange the terms of a Bill in pursuance of the "before-mentioned notice, to be promoted jointly by the "Corporation and the Board." The Court of Common Council are, of course, unanimous in their proceedings, barring the opposition of one gas shareholder, who very properly thought that the citizens of London might as well rely on the generosity and good feeling of the Chartered Gas Company, as on the restrictions of an Act of Parliament, through which many coaches might possibly be driven. A simple agreement with the Company would, in our opinion, answer all the purposes of an Act of Parliament, supposed to be stringent, but every section of which, in reality, might be open to challenge. The Common Councilman was perfectly right when he argued that the Court would be quite safe in the hands of the Company, but the majority did not think so. The Company, we are sorry to say, is considered fair game for plunder within the limits of the City of London. No security that we know of can be given, which will prevent repeated attacks on their interests, until, let us fairly confess it, the undertaking passes from the hands of the Company. After that, complaints in respect to the gas supply will be as common as ever, but they will be stifled by the accused authority, whatever it may be.

The Court of Common Council have resolved, as already stated, to confirm the action of their Gas and Water Committee in promoting the Bill which we have previously noticed, and by-and-by we shall see what will come of their action. With regard to penalties and forfeitures, we do not exactly understand what alterations the Corporation wish to make; but as regards illuminating power, we may here suggest that a three days average should be fixed, the same as for impurities under the Company's Act of 1876. This would enable the Company to furnish, as a rule, a higher quality of gas, which might sometimes sink below, but generally would be far above the standard. The three days average would be perfectly fair to both Company and consumer. If we consider the condition of affairs at the present day, it will be seen that great differences in illuminating power must be experienced according to circumstances. It is well understood that a single test, or several made in one evening, cannot fairly represent the illuminating power which obtains through the seventy-two hours, which, we suggest, should in all fairness be taken to indicate the average illuminating power, just as we have the average of the three days tests for impurities.

A better system of illuminating railway carriages has long been desired. To our mind, the simple lighting with common coal gas proved eminently successful; but the misfortune was that the bags containing the gas required frequent refilling. One of the first men to recognize this difficulty was Herr Pintsch, of Berlin, who invented a method of obtaining permanent gas from crude petroleum oil, and compressing it into large cylinders, from which smaller cylinders, placed under the railway carriages, were filled. What we consider an improvement on this plan has been recently experimented upon by the Chartered Gas Company, who have been carburetting the common gas made at their King's Cross works, by means of an apparatus invented some time since by Mr. Frank W. Clark. The gas, saturated with the vapour of petroleum, is compressed to about ten atmo-

spheres, in cylinders placed on the tops of carriages, and thence supplied to the burner in a compartment of a carriage. The burner used is, we believe, a modification of Sugg's "London" Argand, being furnished with a flash-light fixed in the centre of the ring. With this latter appliance—the gas for it being supplied at high pressure as compared with the Argand—there is no fear of the lights becoming extinguished under any accidental circumstances. Should, for instance, a collision occur, and the larger flame be extinguished, the smaller one will immediately re-light the gas, and thus the continuity of the illumination is maintained. The compressed mixture, which is represented by about ninety-eight per cent. of ordinary coal gas and two per cent. of petroleum, gives, we are told, an illuminating power of between thirty and forty candles, and thus, if a fair quantity be burned, the illumination must be in the highest degree effective. It is satisfactory to know that a carriage thus lighted is able to travel from London to Aberdeen and back without requiring any replenishment.

We have mentioned above that a Common Councilman of the City of London who enjoys the additional felicity of being a Shareholder in a Gas Company, tried to impress upon his colleagues that they might safely trust themselves in the hands of the Chartered Gas Company, for obtaining all that is needed for a proper supply of gas at a reasonable price. To show that such reliance would not be misplaced, we may mention that the Company, as reported in last week's issue, have given notice of a reduction of twopence per thousand feet, which will come into effect on Jan. 1, and make the charge 3s. 4d. per thousand feet. This is a large reduction, and should satisfy those objectors who contend that the Company take no care of the interests of their customers.

We have already mentioned that the Town Council of Hull are extremely anxious to make a trial of the electric light for the illumination of their thoroughfares and public buildings. For this purpose they have given notice of a Bill to enable them to spend public money with a view to making experiments. Whether this measure will be proceeded with or not remains to be seen, but in all probability it will be dropped. Hull, it must be admitted, is very awkwardly situated with regard to its gas supply, and we can scarcely wonder that the Corporation should endeavour to emancipate themselves from the gas trammels which surround them. There are, as most of our readers well know, three Companies supplying gas within the Corporation limits. One charges £4 7s. 3d. for each public lamp; the second, £4 per lamp; the third and last—the British Company—charge only £3 5s. per lamp. If the Corporation could be entirely supplied at this last figure, we may take it that no thought would arise in their minds as to the use of the electric light or any other novel means of illumination. But how could a general reduction in price be brought about? Obviously, by one agency only, and that is amalgamation between the Companies. We have recently seen in the Metropolis the price in the district of a Company who charged 3s. 9d. per thousand feet reduced to 3s. upon amalgamation. A similar saving to this, or nearly so, we believe, might be effected at Hull, if the other Companies united with the British. The prices for gas in Hull to private consumers now stand at 4s. (to be reduced at Christmas to 3s. 6d.), 3s. 9d., and 2s. 6d. per thousand feet. There is here clearly room for some combination, which would result in a general reduction. As a matter of course, union could only be effected by a special Act of Parliament, which could be easily obtained. That done, gas agitation in Hull would entirely cease and determine, peace being restored, and general contentment resulting.

Messrs. Siemens, who are foremost in making experiments with the electric light, commenced a novel one last Saturday in the High Street and Market Place at Woolwich. The novelty of the exhibition, we are told, consists mainly in suspending the lamps in the centre of the thoroughfare, from the tops of the houses, in the way which our grandfathers will remember the oil-lamps were in some places hung. It is reported that each light employed possesses the illuminating power of six thousand candles. We need only add that the new venture is the result of the private enterprise of certain local tradesmen, and that the lights will, for the present, be used only on Saturdays.

Last Wednesday witnessed the ceremony of opening the new gas-works of the Leicester Corporation. These, it must be admitted, reflect great credit on the designers and contractors, and the utmost gratification is expressed by all concerned. A description of the works will be found in another column, and from this it will be seen that they are of a most complete character in every particular. Although, as is well known, we strongly object to transfers of gas undertakings to Corporations, we have no hesitation in wishing them success when, as at Leicester, the works have been acquired on equitable terms.

The gas accounts of the Corporation of Rotherham for last year show a profit of £5401, which is applied as follows:—There is, in the first place, an allotment of £2753 to the water-works department—a very significant item; next we have £1671 devoted to the district-fund—that is, in aid of rates; lastly, we have £976 paid to a contingent-fund—this last being a perfectly legitimate disposition of gas profits. We have often made the remark that "every tub should "stand on its own bottom," and for this reason we emphatically protest against the application of profits wrung from gas consumers being appropriated in relief of rates and in making up for losses on a water department. There is, we learn, a probability that the price of gas will shortly be reduced in Rotherham, so we will leave the matter for the present.

The fortieth quarterly meeting of the Manchester District Institution of Gas Engineers was held on the 29th ult., under the presidency of Mr. T. Newbigging, M.I.C.E. The President finishes his year of office this quarter, and will be succeeded by Mr. Carr, of Halifax, than whom probably a more able successor could not have been found. The main point of Mr. Newbigging's address was the revival in trade and its probable effect on gas industry. He anticipates that the rise in the price of gas coals will not exactly follow that of coals used in other industries, notably of those employed in the iron trade. We shall be well content if this turns out to be the fact; but our own opinion leads us to the belief that all classes of coal will follow up, and will eventually find their level. It is not at all likely that, as Mr. Newbigging puts it, a return will be made to the famine prices of 1873; but it is well for us to look ahead; for all the agitating elements of 1873-4 are still at work, and at any time large additions may be made to the prices of gas coals. This is a point upon which the Directors of Gas Companies must keep their minds, and be in no hurry to reduce the price of gas.

The first paper read at the meeting was a most instructive one. It dealt with the subject of economy of heat in retort-settings, and advocated, as we have done for long years, the use of regenerative furnaces. The furnace which Mr. Webber advises for general use, is perhaps the best for gas-works—viz., the Oechelhäuser, to which allusion has often been made in these columns. In regard to retort-setting, whether solid or gaseous fuel be used, Mr. Webber well put it when he said that the quantity of air admitted in a furnace should be restricted to the proper quantity, and that quantity being used in a proper manner. In this lies the not very simple secret of obtaining the largest quantity of heat from a minimum amount of fuel. The paper will command the attention of our readers, and we look forward to the future when the use of regenerative furnaces will be the rule rather than the exception.

The other papers read were—"On the Testing of Gas-"Mains," by Mr. F. W. Brothers; "Notes on Condensation," by Mr. T. O. Paterson; and "On an Improved Purifier," by Mr. W. Tyrell; and of them we shall probably have something to say when they appear in the JOURNAL, which we hope will be next week.

Water and Sanitary Notes.

THE half-yearly report of the Southwark and Vauxhall Water Company, which we have received, shows a healthy state of things. The business of the Company continues to increase, and during the past half year they have laid 6303 yards of new mains, 317 of which are outside the Company's parliamentary district. Under these circumstances, we hope that in the Bill which the Company are promoting, a clause will be introduced to provide for an extension of limits. At the present conjuncture of affairs, when it would really appear that a transfer of the water affairs of the Metropolis is imminent, it is essential that the Company should provide themselves with the widest powers they can obtain. As we have already informed our readers, the Company are promoting a Bill for the purpose of raising further capital for the construction of new works, &c., in order to give increased facilities for furnishing a constant supply. It is not mentioned, in the report of the Directors, that the Company contemplate leading an amalgamation of the Metropolitan Water Companies. Perhaps they will not succeed in the attempt, and for this reason, probably, no mention of the Bill is made in the report. Still, amalgamation is highly desirable; but the suggestion, as we may call it, thrown out by the

Southwark and Vauxhall Company, we hope will be taken up and energetically pushed. Before any transfer of the undertakings is made, it is essential that their interests should be consolidated. They would doubtless hang well together, and, indeed, in this report we find an intimation that the terms of purchase suggested by Mr. Cross would not be accepted by the Southwark and Vauxhall Company. The value of the Company's undertaking increases day by day, and whenever it is parted with, it must be at a price to be fixed when the purchase is made. Our Vestry friends will find themselves much mistaken if they suppose for one moment that the idea thrown out by Mr. Cross can be carried into effect; but on this point we need not say more at present. It will not be many weeks before we learn what the exact resolution of the Government is with respect to the Metropolitan Water Supply.

But to return to the accounts of the Southwark and Vauxhall Water Company. The profits of the Company applicable to dividend for the past half year, added to the available balance, amount to £45,050, which enables the Directors to recommend the payment of a dividend of six per cent. per annum, which shows that the Company have increased, and are increasing in prosperity. Of course, while the Company, like the other Companies, are doing their utmost to improve their supply at any cost short of what would prove their ruin, an agitation is continually being kept up, with the twofold object, first, of reducing the rates, and next, of improving, as some would say, the character of the supply. The Company are at the present moment charged with supplying "diluted sewage" at an "extortionate" rate. Presently we shall see what the Government, under Mr. Cross's inspiration, will do; but we rather think that the ratepayers on the south side of the river will continue to imbibe what they call "diluted sewage," and pay for it at an "exorbitant" rate.

How far the Southwark and Vauxhall Company's water can be represented as "diluted sewage" may be seen from Dr. Tidy's report, which we publish in another column. We may at once freely admit that, as regards organic matter, that Company's water certainly does look the worst in the Doctor's report of the Thames supply; but, after all, the proportion is exceedingly minute, and who knows whether this minute proportion is harmful or not. If people are anxious about it, we may refer them to the experience of the Munich doctor which we recently reported. On the whole, Dr. Tidy's report is an eminently satisfactory one. It shows that the Metropolitan Water Supply is excellent as regards quality, and we know it is plentiful as regards quantity.

We have several times remarked that the Liverpool Town Council would have to encounter severe opposition in the carrying out of their Vyrnwy scheme. Last week a deputation from several cities and boards waited upon Lord Sandon, at the Board of Trade, to urge that if the scheme of the Liverpool Corporation is carried out, the salmon fisheries of the Severn would be seriously interfered with, and the navigation of the river greatly obstructed. We may afford to make light of these allegations, because eminent engineers have stated that such statements have no foundation in fact. But, after all, what is the infinitesimal amount of water which the Liverpool Corporation will take, relatively to the vast body which pours down the Severn Valley? Lord Sandon's reply to the deputation was an extremely cautious one. He told them that their interests would be fully considered by the Government, and he would take care that the fullest information should be furnished to the executive.

THE ACTION OF COKE SLAG UPON FIREPROOF MATERIALS.

In a recent number of the *Journal für Gasbeleuchtung* an article appeared on the above subject, from the pen of Dr. B. Kosmann, the following being an abstracted translation of it:—

It has long been known that the durability of fireproof materials is not only dependent upon the degree of heat to which they are subjected, but also to a great extent upon the action of the slag or cinder produced either by the substances heated or by the ashes of the fuel used. This action of the slag is the more injurious where a stoppage of the furnace for repairs would involve a serious interruption and excessive cost, and is especially the case with the regenerator furnaces now in such extensive use for heating gas-retorts. These regenerators are usually worked with coke, which, according to Kraus, in his "*Etude sur le Four Siemens*," is the most suitable fuel for the purpose. The form of the regenerators is generally very simple, consisting of a cavity for the reception of the fuel, provided with side or bottom slits, through which the necessary supply of air is admitted. A grating is not necessary, or, if present, it plays a subordinate part, merely assisting to fuse the slag running down from the slits above.

The working of the regenerators depends chiefly upon the manipulation of the lower slits. At the high temperatures at which the combustion of the coke is effected, the ashes fuse and form a liquid slag, which runs down through the slits and is then removed. It is in this part of the furnace that the wear of the fire-bricks is the greatest, owing to the high temperature combined with the action of the fused slag and the evolution of carbonic acid. The composition of these fire-bricks should be adapted to the acid or basic nature of the slag in each case. Although our knowledge of fireproof materials has been greatly increased by the researches of Bischof and Seger, there is a great gap in the technical literature with regard to the composition of the ashes of coal and the slags produced from them. Hitherto the examination has been limited to the composition of the ash and its general character.

At the meeting of the German Gas and Water Managers Association at Leipsic, in 1877, the wish was expressed that the fire-brick manufacturers should turn their attention to the analysis of the slags produced from coal-ash, which affords the only means of arriving at a suitable choice of materials. This is now done by several of the larger fire-brick manufacturers of Germany, as was shown by the researches of the Commission, upon whose reports was based the series of articles on "Experiments with Generator Furnaces," which a short time since appeared in the JOURNAL; as well as by the experiments on fuel recently made at Munich.

The following analyses of coke ashes, and of slags resulting from them, are taken from practice, and may be regarded as types of acid and basic slags. They are well adapted for showing the changes produced in the component parts of the ash, either by volatilization, the reduction of distinct substances—for instance, metallic iron—or the absorption of the constituents of the fire-bricks themselves. They not only show what changes take place; but also how erroneous it would be to attempt to deduce the composition of the fused slag from that of the ash from which it is derived.

I. In the gas- works at M. G., coke made of German coal from Gelsenkirch was burnt in Müller and Eichelbrenner's regenerators. The coke contained 11·92 per cent. of ash, which consisted of the substances mentioned in the subjoined table:—

	Total.	Soluble in Water.	Oxygen in the Silicate.
Silica	47·91	—	25·55
Alumina	30·17	—	14·09
Ferric oxide	12·16	—	—
Manganic oxide	0·38	—	—
Lime	1·41	0·24	0·33
Magnesia	1·22	0·41	0·32
Soda	2·60	0·20	0·61
Potash	3·34	0·26	0·52
Sulphuric acid	0·82	0 84	—
	100·01	1·95	

The ash was of a light reddish colour; but it could not be ascertained whether the whole of the oxides of iron and manganese were present in a free state, as they could not be completely dissolved by hydrochloric acid. The aqueous extract was a basic compound of sulphates. Those bases which were not combined with sulphuric acid may have been present in the coal in the form of carbonates, which were decomposed and became caustic during combustion. The formula of the remaining silicate was—

$$2\,(R\,SiO_3) + 5\,(Al_2\,Si_2\,O_7) + 2\,SiO_2$$

i.e., a normal silicate of alumina with a small proportion of free silica.

This formula confirms the observation that the ashes of many kinds of coal, when deprived of iron, resemble fire-clays in their chemical structure. The slag which ran out of the generator had the following composition:—

	Total.	Oxygen.
Silica	62·95	33·57
Alumina	25·23	11·78
Ferrous oxide	3·12	0·69
Manganous oxide	0·28	0·06
Lime	0·46	0·13
Magnesia	0·92	0·36
Soda	2·82	0·72
Potash	3·51	0·59
Phosphoric acid	0·55	0·31
Metallic iron	0·09	—
Ferric sulphide	0·04	—
	99·97	

The slag formed a dark homogeneous glass, with few pores, and containing globules of metallic iron. It was but slightly soluble in hydrochloric acid, without gelatinizing. Its specific gravity, when coarsely powdered, was 2·52.

It will be seen on comparing the analyses of ash and slag that the oxide of iron contained in the former was reduced by the incandescent coke and partially separated in the metallic state. The sulphates of lime and magnesia were volatilized or removed mechanically in the form of dust, while the fixed alkalies passed into the slag. Partly owing to the removal of these basic constituents, and partly to the absorption of the fireproof material from the walls of the furnace, the proportion of silica was considerably higher, so that the basic ash had produced an acid refractory slag. The composition of this slag indicates a normal silicate of the formula—

$$2\,(R\,SiO_3) + 3\,(Al_2\,Si_3\,O_9) + 2\,SiO_2.$$

The fire-bricks with which the generator was lined were of a light reddish colour, with angular fragments of quartzite, and contained on an average 88·90 per cent. of silica. They showed but

little signs of deterioration, which justifies the conclusion that the high proportion of silica succeeded in resisting the action of the acid slag.

II. In the gas-works at St., a new furnace was erected on Liegel's system. It was heated by means of gas coke made from a mixture of two-thirds Nettlesworth and one-third Leverson coal. This coke contained 9·24 per cent. of ash, the composition of the latter being—

	Total.	Soluble in Water.	Oxygen in Silicate.
Silica	43·34	—	23·11
Titanic acid	0·86	—	0·55
Alumina	21·16	—	9·88
Ferric oxide	11·84	—	—
Manganic oxide	0·61	—	—
Lime	10·53	4·18	1·81
Magnesia	0·41	0·41	—
Soda	0·86	0·83	—
Potash	1·88	0·59	0·22
Sulphuric acid	7·17	7·17	—
Phosphoric acid	0·61	—	—
	99·27	13·18	

The ash was of a light reddish colour; its aqueous extract representing a slightly basic combination of sulphates. If we omit those constituents which are soluble in water and the oxides of iron and manganese, the remaining silicate will possess the formula—

$$Ca\,(K_2)\,SiO_3 + 2\,(Al_2Si_2O_5) + \tfrac{1}{3}\,CaTiO_3.$$

The first sample of slag (A) was taken after the furnace had been in full work three days. It was refractory and tough, hardening so quickly that much care was needed to prevent the slit from choking. After the furnace had been working four weeks, it was found that the air-slit could be advantageously reduced to 8 inches in length. This having been done, a second sample of slag (B) was taken. In consequence of the much higher temperature caused by the reduced aperture, this slag was more thoroughly fused. The fire-bricks composing the furnace lining were made of a mixture of best fire-clays, and those bricks immediately adjoining the aperture for the admission of air contained as high a proportion of alumina as possible. When the regenerator was first worked, a slight vitrification of the fire-bricks was observed; this entirely ceased, however, as soon as the walls had become coated with slag. At this stage the slag did not absorb any substances composing the fire-bricks.

Sample A had the following composition:—

	Found.	Calculated.	Oxygen in Silicate.
Silica	51·80	51·80	27·62
Alumina	29·27	29·27	13·66
Ferric oxide	11·24	—	0·80
Ferrous oxide	—	3·63	—
Manganic oxide	1·26	—	0·26
Manganous oxide	—	1·17	—
Lime	6·85	6·85	1·95
Magnesia	1·12	1·12	0·44
Soda	0·33	0·33	0·08
Potash	0·70	0·70	0·01
Metallic iron	—	5·04	—
	102·57	99·91	

The apparent excess found is due to the oxygen of the iron and manganese compounds; the lower products of oxidation having been formed by the action of the incandescent coke. The titanic acid was not estimated separately in this analysis, but included in the silica. This slag appears to be a combination of a normal silicate of the protoxides with a two-thirds silicate of alumina, corresponding to the formula—

$$4\,(R\,SiO_3) + 5\,(Al_2Si_2O_7).$$

The conclusion to be drawn from this is, therefore, that the slag has become more basic than the ash, owing to the fusion of free bases contained in the latter; and partly, perhaps, to the absorption of the substance of the fire-brick lining.

In the second sample of slag (B) still more important changes were evident. It consisted of a dark, compact glass, filled with globules of metallic iron. These globules were brittle, and easily separated from their matrix. Part of the slag was coarsely powdered, and the globules of iron separated by means of a magnet. They formed 9·91 per cent. of the whole. The specific gravity of the slag was 2·97; of the globules of iron, 2·85. Treated with warm hydrochloric acid, this slag gelatinized, without completely dissolving. At the same time sulphuretted and carburetted hydrogen were evolved. Its composition was found to be—

	Total.	Oxygen in Silicate.
Silica	34·55	18·42
Titanic acid	3·40	2·17
Alumina	41·26	19·26
Iron	3·75	—
Ferric oxide	0·43	0·09
Manganic oxide	0·25	0·06
Lime	15·14	4·32
Magnesia	0·57	0·22
Soda	0·06	0·01
Potash	0·67	0·11
Sulphur	0·19	—
	100·27	

If we compare these slags, we find that both possess one feature in common—namely, the absence of the sulphates, which seem to have undergone volatilization. It appears also that part of the sulphate of lime has been decomposed, and remains in the slag. The globules of iron were found to be very impure, only containing 35·70 per cent. of metallic iron.

Of the greatest importance is the volatilization of the slag. This cannot solely be attributed to mechanical causes, the draught in the regenerator being but slight. It must be partially due to chemical decomposition. Not only those substances which are known to be volatile were volatilized, but also the silicate forming the bulk of the slag. After the furnace had been working for some months, the draught, and consequently the temperature, were found to diminish considerably. The flues were then opened, and their inner surface was found to be covered with a 2 to 3 inch coating of a light yellow friable substance, which floated upon water without absorbing it. Its quantitative analysis gave—

	Total.
Silica	72·34
Alumina	3·67
Ferric oxide	5·34
Manganic oxide	1·33
Lime	1·59
Magnesia	2·55
Soda	1·87
Potash	2·00
Sulphuric acid	7·98
Residue (graphite)	0·32
	98·99

It was remarkable that nearly two-thirds of the silica could be extracted by boiling in a solution of caustic soda and carbonate of soda, showing that the slag had undergone decomposition by the action of the steam, assisted, perhaps, by the sulphates present.

III. At the gas-works at B. some experiments were made with regenerators lined with the best Garnkirk bricks. These always contain a certain percentage of iron and traces of manganese. The coal used was from Zabrze, in Silesia, and contained 3·54 per cent. of ash. This ash consisted of—

	Total.	Oxygen in Silicate.
Silica	61·18	32·62
Alumina	26·07	12·17
Ferric oxide	7·32	2·19
Lime	1·32	0·37
Magnesia	1·18	0·47
Soda	0·33	0·08
Potash	1·79	0·30
Loss as gas	0·47	—
	99·66	

The ash was therefore easily fusible, like that of most of the Silesian gas coals. In consequence of the fusibility of the slag, the lining of the furnace was soon attacked; and, in a short time, completely destroyed. As soon as the outer skin of the fire-bricks was corroded, the interior began to swell, leaving interstices between the grains of burnt fire-clay. The liquid slag then ran into these interstices, and completed the work of destruction. Those bricks which had remained entire showed incipient fusion to a depth of about three-quarters of an inch. The fragments of the bricks which had been disintegrated were covered with a vitreous crust. This crust was separated from the substance of the fire-brick and analyzed, with the following result:—

	Total	Oxygen in Silicate.
Silica	61·32	33·57
Alumina	23·79	11·11
Ferrous oxide	7·41	1·64
Manganous oxide	0·78	0·17
Lime	3·60	1·03
Magnesia	1·50	0·60
Soda	0·80	0·20
Potash	1·35	0·23
	100·55	

The result of the fusion was to produce a still more acid silicate. The regenerator was, consequently, re-lined with fire-bricks analogous to those used in experiment No. I., and the results proved highly satisfactory with regard to durability.

Gas for Railway Carriage Lighting.—The Chartered Gas Company have recently carried out an experiment, which has conclusively proved that it is possible for them to arrange for the lighting of railway carriages in a most brilliant manner as compared with any system hitherto adopted. About a month since, the Great Northern Railway Company commenced running, on their line between London and Hatfield, a coach lighted with common coal gas, manufactured by The Gaslight and Coke Company at their King's Cross works, but carburetted by an apparatus the invention of Mr. Frank Clark (brother of Mr. John Clark, the Engineer at the St. Pancras station of the Gas Company), and afterwards compressed. The gas is consumed in a "London" Argand burner, specially modified for the purpose by Mr. W. Sugg, of Westminster. A coach lighted in a similar manner has thrice been to Leeds and back, the gas lighting arrangements answering admirably; and, though on the journey a speed of 65 miles an hour was at times attained, the gas remained burning quite steadily. We shall, in an early number, give drawings and description of the whole apparatus employed, including Mr. Clark's carburetting machine and Mr. Sugg's arrangement for the combustion of the gas.

Communicated Article.

THE CORROSION OF IRON.

By Mr. William Foster, M.A. (Cantab.), F.C.S., &c.,
Professor of Chemistry at the Middlesex Hospital.

Second Article.

The result of the chemical union of carbon and iron is generally regarded as forming a carbide of iron, and for the present we will consider a case in which a given sample of iron consists almost entirely of such carbide, and we will further suppose that the carbide is perfectly homogeneous in its character. Our saturated syrup, when at rest and of a uniform temperature throughout its whole mass, affords us an instance of homogeneity of structure; but as it is a liquid, it may lead to some misunderstanding if we bring it forward in our present considerations as a case analogous to that of solid homogeneous carbide of iron. By homogeneity, or uniformity of structure of carbide of iron, is meant that there is not only uniformity of chemical composition throughout the whole of the mass of the sample, but also that the physical condition of the whole mass is uniform. In such a case there is an absence of all crystalline and fibrous texture. Portions removed at different points in the mass would have the same hardness, specific gravity, and other physical properties. White cast iron most nearly approaches our ideal standard.

Now suppose a specimen of this homogeneous carbide to have particles of crystalline carbon or graphite disseminated throughout its whole mass. The result will be a non-homogeneous iron, the non-homogeneity being due to the small pieces of graphite, interspersed throughout a uniform medium, of a different specific gravity and of an entirely different chemical character. Grey cast iron supplies us with an example most nearly approaching what we are considering. Of course, the quantity of graphite relatively to the whole weight of the sample of iron can only be small, and in our former article we considered the extreme limits which are found in each of the three typical forms of iron. Let us now consider some of the characters of the crystalline carbon (graphite), and also the characters of the carbide of iron through the substance of which it is interspersed, so that we may be the better able to understand the behaviour of the two when occurring together, as they do in the ordinary forms of iron.

Graphite, as it occurs in iron as uncombined carbon, is a black crystalline substance. It is familiar to all of us in its natural form as the black lead of writing pencils, or the black lead used by domestics for imparting a polish to iron stoves. It has a specific gravity of about 2·2, and is unalterable by exposure to atmospheric air and moisture. It can resist the action of a large number of chemical agents, and requires a very high temperature in order to burn it in atmospheric air, the combustion even then being slow. Mineral acids, such as sulphuric, do not chemically affect graphite under all ordinary conditions. Its behaviour is well illustrated for our present purpose by the carbon rods or plates employed in the galvanic cell devised by Prof. Bunsen, and named after him. In this arrangement a rod of compressed crystalline carbon (gas coke carbon) is immersed in strong nitric acid placed in a cell of porous earthenware. This porous cell is surrounded by a larger one, usually made of glass, and containing dilute sulphuric acid, in which a plate of amalgamated zinc is placed. On connecting the carbon and zinc plates by means of a metal wire outside the liquids, an electric current traverses the whole circuit, passing along the wire from the carbon to the zinc plate. Were we to replace the zinc plate by one of white cast iron (or any other form of iron), we should obtain similar electrical effects, the difference being mainly that of obtaining a supply of electrical energy at the expense of a quantity of iron consumed in the sulphuric acid cell instead of zinc. The carbon in this arrangement is positive to the zinc or iron, and from the circumstances of the case is a good conductor of electricity, otherwise there would not be a current of electricity when the two plates are connected by means of the wire. Further, the carbon undergoes no chemical change during the solution of the zinc or iron.

On the other hand, carbide of iron (white cast iron) is a substance having a specific gravity of about 7·0. It is attacked at ordinary temperatures by dilute mineral acids, though not so readily as the other forms—grey cast iron, wrought iron, and steel; the differences in this respect probably being due to the almost complete absence of crystalline carbon (graphite) in its substance. As might be supposed, it is also much less prone to oxidation than the other three forms just enumerated.

The non-homogeneous iron which we have thus considered owes its non-homogeneity to the presence of crystals of graphite scattered throughout the mass of the sample, and when this is placed in a medium which is capable of exerting chemical action on the carbide of iron, results follow, which, in the main, are analogous to those which follow when the poles of the Bunsen cell are connected by a wire. As we have seen, the chemical habitudes of the two substances, graphite and carbide of iron, are widely different. Therefore there are scattered, all over the surface of the sample, minute galvanic couples in a medium capable of affecting the negative element—namely, the carbide of iron. The poles, from the nature of the case, are in intimate contact, and chemical action is intensified by such an arrangement.

We have now to consider a second form of non-homogeneity which may co-exist with that already considered. When a piece of polished wrought iron or steel is touched with a dilute mineral acid the surface is not only blackened, showing that free carbon is present, but, in addition, it is found that the iron or steel, as the case may be, does not dissolve uniformly, but gives a surface which shows the presence of lines or spots. This result is best obtained by using a strength of acid which attacks the metal slowly, thus allowing the action to be prolonged. Again, when a bar of wrought iron or steel is broken, the surface exhibits a fibrous or granular appearance; and this fact, coupled with evidence obtained by the action of dilute acids, points to the existence of structural form. In short, the fibrous or granular character is produced by special treatment in manufacture. In the process of piling or fagoting, the bar iron is cut into given lengths. Several of these lengths are then placed on each other, the whole raised to a welding heat, and then passed between rollers so as to produce one complete bar, the structure of which, when examined, is markedly fibrous. Such a material, made up of granular or fibrous parts, admits of being altered by hammering or pressure, either of which tends to make the fibres or granules approximate more closely, and in that way increases the specific gravity of the portion of the mass so treated. If, then, a piece of fibrous bar iron, uniform in other respects, be hammered at one end, that end becomes denser than the unhammered portion, and the piece of bar iron, regarded as a whole, after such treatment, would be composed of two parts in different physical states. A second kind of non-homogeneity would in this way be imparted to the iron, which would modify its behaviour when submitted to chemical influences under given conditions. The two ends would not be equally acted on by very dilute acids, were the sample immersed in the acids, and allowed to remain for some time—in fact, one end would partially save itself at the expense of the other. The behaviour of iron which is non-homogeneous from the foregoing cause may be illustrated as follows:—Suppose a piece of fibrous bar iron to be cut into two equal parts, and one of them to be subjected to severe hammering on an anvil until its density was increased; further, suppose the two pieces of bar iron to be immersed in dilute sulphuric acid, without touching in the liquid, but connected by means of an iron wire outside the acid; electrical effects would follow similar to those we have already considered, the harder iron being positive relatively to the softer unhammered iron. The current of electricity would, in this case, be a feeble one, though none the less obvious if suitable means were taken for detecting its existence. In this instance the electrical energy is derived from the greater consumption of the soft unhammered iron. The case is analogous to the one already cited, where carbon is positive relatively to iron of every description, and many other metals when used in substantially the same way. When a bar or piece of wrought iron, such as a bolt, is unequally hammered, the second kind of non-homogeneity is imparted to it in a greater or lesser degree; and, therefore, when the whole piece is subjected to slow processes of oxidation, or other chemical action, the harder parts are positive to the softer unhammered, or partially unhammered parts, and therefore electrical actions are set up and maintained at the expense of the softer iron. Practical instances of these conditions are afforded by the iron rivets employed in binding together iron structures. The heads of the rivets are hardened through the hammering to which they are subjected, and if by any chance the rivet is exposed to powerful corroding influences, whilst at the same time the part of the rivet near the head becomes exposed, the corrosion is much greater at this part than the other. The binding together, therefore, of iron in different homogeneous states, and subjecting the combination to influences tending to corrode or act on the iron, is accompanied by the greater corrosion of the softer iron, such action being much facilitated by the voltaic couple or couples which have been, perhaps unwittingly, brought into operation.

(To be continued.)

Death of Mr. G. Buist, of Nova Scotia.—The *American Gaslight Journal* announces the death, on the 2nd ult., of Mr. George Buist, Manager of the Halifax (Nova Scotia) Gas-Works.

Institution of Civil Engineers.—At a meeting of the Institution last Tuesday, among the Associate Members elected were Mr. Frederick Edward Linging, British Gaslight Company, Norwich; Mr. Redmond John Brough, Engineer and Manager of the Toronto Water-Works; and Mr. Edward Hall Allies, Engineer and Surveyor of the West Derby Local Board.

Manchester Corporation Gas Supply.—At the monthly meeting of the Manchester City Council last Wednesday, on the motion of Alderman Lamb, seconded by Mr. Harwood, it was resolved that application should be made to the Local Government Board for a Provisional Order to alter and amend the Manchester Corporation Water-Works and Improvement Acts, so as to confer on the Corporation power to borrow, for purposes connected with their gas-works, the sum of £250,000.

The Recent Explosion at the Bradford Corporation Gas-Works.—The adjourned inquest on the body of William Holt, a stoker in the employ of the Bradford Corporation, whose death resulted from injuries received by the recent explosion at the Thornton Road gas-works, was resumed on Monday, the 1st inst., before Mr. J. G. Hutchinson, the Borough Coroner. John Markham, engine-tenter, stated that he was employed at the works, and had charge of the engines on the night turn. Holt was a stoker, and Ryder (the other injured man) was the night foreman. On the evening of Nov. 21 he heard Ryder say to a stoker named Barker that there was a difference of 20,000 feet of gas between the amount manufactured on one side of the works and the gas made on the other, and that there must be something wrong. He and Barker continued to converse for a few minutes. Witness saw Ryder frequently from that time during the night. About 3.35 on the morning of the 22nd (Saturday), Ryder came into the engine-house for a lamp, and about five minutes after he had left, witness heard an explosion. On going outside, he saw that the purifying-house had been blown down, and other damage had been done. At the conclusion of this witness's evidence the Town Clerk (Mr. W. T. M'Gowan), entered the room, accompanied by Mr. D. Swallow, the Manager of the works, and explained to the Coroner that the works were about to be inspected on behalf of the Corporation by Mr. T. Hawksley, C.E., of London, and it was expedient for Mr. Swallow to be engaged in the inquiry as to how the supply of gas to the town could be improved without delay. He asked for an adjournment of the inquest for a week, which was granted.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE REMOVAL OF TAR FROM THE HYDRAULIC MAIN.

SIR,—I would not have troubled you with any remarks on the subject referred to in the heading, had it not been for the appeal contained in the letter signed "A. Ford" which appears in the last issue of your JOURNAL.

In May, 1858, I became Manager of the Perth New Gas-Works, as successor to the late Mr. Robert Ford, and I found working—and evidently having been working for, I may say, some years previously—an arrangement such as Mr. Whimster mentions for withdrawing the tar from the hydraulic main—viz., a bent tube from the under part of the main, met in a T-piece by a connection from the top of the same; and I think (but of this I am not quite certain) regulated by a sluice-valve in a similar manner to that described.

I always understood this to be an original idea of my predecessor, Mr. Ford, and I do not remember noticing, or having had pointed out to me, any similar arrangement at the Old Gas-Works, of which Mr. Whimster was then Manager.

I make these remarks simply as an act of justice to the person I believe to have been the originator of the idea. *Aut Cæsar*, &c., &c.; and, unless some earlier claimant appears, it seems to me that to Mr. Ford belongs the honour of having been the original inventor; to Mr. Whimster that of bringing it before the world in a communication which I feel sure merited the reward it obtained; and to Mr. Key possibly the improvement which he claims. At the same time I can vouch for the fact that, during the four years I managed the works I have mentioned, I found no necessity whatever for the improvement which Mr. Key considers so important.

A. F. WILSON.

34, St. George's Road, Southwark, S.E., Dec. 3, 1879.

SIR,—Having read several letters in the JOURNAL about the removal of the tar and regulating the water level in the hydraulic main, and as this has been known to me upwards of 40 years, perhaps you may allow me to say a few words on the subject, and at the same time give the name of the inventor, if it can be called an invention.

In 1838, Mr. Thomas Atkins, who was then the Manager of the gas-works at Shepton Mallet, was called to inspect a small private gas-works at Midsomer Norton, Somersetshire. Seeing that the hydraulic main was fixed too low for the condensers, he drilled a ¾-inch hole in the end of the main, and fixed a bent pipe or syphon, which I kept at work for two years. In 1840 I saw it at work at Shepton Mallet Gas-Works, and I know Mr. Atkins adopted it in many works he erected during the next eight years I was in his employ.

In 1850 I abandoned it, being quite convinced that any system that required attention from the men to regulate the water level was bad and dangerous.

In 1852, when putting up a new hydraulic main, I adopted a very simple contrivance for the removal of the tar, without altering the level of the water, and turned the main into a washer and purifier. On the inside of the hydraulic main, and at about 6 inches from the outlet end, I fixed a partition, or bridge, rising an inch above the water level, and an inch from the bottom of the main, so that the tar and water passed under, and the gas over the top. At the other end of the main I let in a stream of desulphuretted ammonia water, heated to about 80°, by passing it through an iron pipe laid in the sand upon the benches. The gas and the tar were thus washed as they were bubbling from each dip-pipe, and the ammonia water absorbed a large quantity of sulphuretted hydrogen, and effected a considerable saving in lime.

WM. GAIT.

Chilcompton, Somersetshire, Dec. 6, 1879.

We have also received, on the subject of "The Removal of Tar from, and the Regulating of the Water Level in the Hydraulic Main," an interesting letter from Mr. J. Hall, of St. Andrews; but as it is accompanied by several sketches of apparatus, we are obliged to defer its publication till next week, in order to prepare the necessary illustrations. —ED. J. G. L.

BIRKENHEAD CORPORATION GAS SUPPLY.—At the meeting of the Birkenhead Town Council on Wednesday last—the Mayor (Mr. T. H. Jackson) in the chair—the minutes of the Gas and Water Committee were presented, recommending that a further sum of £12,000 be borrowed on capital account, and that bonds be issued for that amount. Mr. Rawcliffe, in moving the confirmation of the minutes, said the amount proposed to be borrowed was necessary to make provisions for land that had been purchased for the purpose of extending the works. Mr. T. S. Deakin seconded the motion. Mr. Booth asked what had become of the accumulated capital of the Committee. Mr. Willmer said the Committee had a balance of accumulated profits of something like £21,000, and asked whether the land in question might not be fairly paid for out of that fund. Mr. Deakin explained that of the amount borrowed, only £1700 was still unexhausted, while the purchased land would cost £8500. It was true that there was in the bank a considerable amount of money to the credit of the estate. Any surplus had, of course, to go towards a reduction in the price of gas and water; but the course followed in keeping the accumulated amount in the bank was, in his opinion, the right one, because it enabled the Committee to benefit present rather than future consumers of gas, by having at hand a fund which could be applied either in preventing of any increase in the price of gas and water, such as might be threatened by a rise in the cost of coal or cannel, or in reducing of the present price to consumers. Mr. Willmer held that the course pursued was an injustice upon the present population for the benefit of a future population. He considered that the ratepayers were entitled to enjoy the advantage of the accumulated profits. A certain amount of the profits of the gas and water undertakings ought, in his opinion, to be set aside as interest upon the amount of the capital invested, and the remainder should go in reduction of the rates of Birkenhead and of Claughton, these two districts being solely responsible for carrying on the works. Alderman Walker thought that consumers ought to benefit, in the shape of a reduction of price, by the fund in question. Mr. Forrest submitted that the banked accumulation was illegal, but Mr. Deakin pointed out that while this would be true of an invested sum there was no investment in the present case. After some further observations, the subject dropped.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, DEC. 4.

(Before Vice-Chancellor HALL.)

ATTORNEY-GENERAL *v.* CORPORATION OF BARNSLEY.

Mr. E. KARSLAKE, Q.C., applied that an injunction granted to restrain defendants from discharging sewage into the river might be suspended for a further period of six months, in order to allow of the necessary works being completed for otherwise disposing of the sewage.

The VICE-CHANCELLOR: Who is your opponent?

Mr. GRAHAM HASTINGS, Q.C.: I have been told that I should be instructed to oppose the motion, but at present I have no brief.

Mr. KARSLAKE: I understood the motion would not be objected to; but if it is, I suppose my friend will require it to stand over in order to answer the affidavits filed in support of the application.

The VICE-CHANCELLOR: You want six months further time?

Mr. KARSLAKE: Yes, my lord. I can prove that we have already done a great deal.

The VICE-CHANCELLOR: I do not want to go into that.

Mr. KARSLAKE: Subject to there being no opposition, I may take an order for six months further time?

The VICE-CHANCELLOR: Yes.

At a later period of the day, Mr. HASTINGS stated that he had been instructed to appear on behalf of the plaintiff, and to consent to the order as prayed, the costs being paid by the applicant.

The VICE-CHANCELLOR made the order as asked.

QUEEN'S BENCH DIVISION.—THURSDAY, DEC. 4.

(Sittings in Banco, before the LORD CHIEF JUSTICE *and Justice* MANISTY.)

HAWKSLEY *v.* BRADSHAW AND ANOTHER.

In this case—which is an action by Mr. Hawksley, the Engineer, against the Proprietor of the *Nottingham Journal*, for an alleged libel in that paper on the 12th of May last, imputing to him, as he complained, improper conduct in his profession—the plaintiff appealed against an order of a Judge at chambers, under the following circumstances:—The alleged libel was in the course of a long article on the subject of the Nottingham Corporation and the Water Company, containing this passage: "The Company's Engineer (*i.e.*, Mr. Hawksley) is anxious not to give up the undertaking, and is also exceedingly anxious to push forward with all possible vigour new works which are not needed, and which will probably not be remunerative if completed." This was complained of as imputing to Mr. Hawksley that he was anxious to push forward new works which were not needful, and which would probably not be remunerative, not *bonâ fide* for the purpose of meeting people's wants, or for any purpose consistent with his duty and honour, but for the purpose of unfairly increasing the price of the Company's undertaking to the Corporation, and for the purpose of increasing his emoluments as the Company's Engineer. The defendants, in their defence, denied that this was the sense, meaning, or contention of the alleged libel; that, in its proper sense, it was true in substance, and related to a matter of public interest, and was published *bonâ fide;* that it was not a libel, but that if it was so it was published inadvertently; and then under Lord Campbell's Act an apology was pleaded, and 40s. paid into court by way of amends. This pleading was objected to, but had been allowed by the Judge at chambers (Justice Field), and this was an appeal by the plaintiff from his decision.

Mr. MURPHY, Q.C. (with Mr. JULYAN DUNN), appeared for the plaintiff, and urged that it was an embarrassing mode of pleading, being a plea of payment into court with a total denial of the cause of action.

Mr. GRAHAM, for the defendants, supported the Judge's order; but after a long legal argument,

The COURT gave judgment for the plaintiff, setting aside the Judge's order allowing the pleading.

PORTISHEAD DISTRICT WATER-WORKS COMPANY.—At the ordinary half-yearly general meeting of this Company, on Saturday, the 29th ult.—Mr. F. Weatherly in the chair—the following report of the Directors was presented:—"During the past six months 62 services have been laid on, chiefly for private consumers; but the arrangements for supplying the dock works and machinery have not yet been entered into. The extensions of mains have proceeded gradually, and are still proceeding as appears expedient, having regard to the supplies required and the resources of available capital of the Company. For this purpose, and also to provide for the future storeage of the large quantity of surplus water now running to waste at the Springhead works, and for substituting masonry for timber in lining the shafts, it is proposed to authorize the exercise of the Company's borrowing powers to the smaller limit provided by the Act, being £1730, in addition to the existing amount issued. It is also proposed to simplify the capital and dividend account by converting, in the case of such Shareholders as may wish to do so, the amount of their paid-up capital on existing shares into stock, carrying, of course, the same dividend and voting powers as an equal amount in shares. To fill the vacancy occasioned by the death of Mr. A. Smee, Mr. F. A. Pullen, one of the original Shareholders of the Company, has been elected." The report was adopted, and the usual dividend declared.

IMPERIAL WATER AND GAS CORPORATION, LIMITED.—The week before last two meetings, convened by the above-named Company, were held, one at Harlow and the other at Epping, for the purpose of explaining the proposal for supplying with water Sawbridgeworth, Harlow, Potter Street, Latton, Netteswell, North Weald Bassett, Epping, Theydon Garnon, and Theydon Bois, with a view to obtaining the co-operation of the inhabitants in carrying out the works. One of the Directors (Mr. W. Clarke, M.I.C.E.) referred to the constitution of the Company, which was established in February last year, and was intended to aid in supplying water and gas in districts where the inhabitants were unable to provide the whole capital required. It was believed, he said, that a number of small undertakings, under one efficient management, with good officers, might be much better and more economically worked than if each were controlled by a local body of directors having no special knowledge. The Company had already successfully taken up the supply of gas to New Quay, in Cornwall; and, in the present instance, it was proposed to work under the powers conferred by the Herts and Essex Water Order, 1879, and sink a well near the Harlow Mill, where the chalk could be reached at a depth of about 100 or 120 feet. The opinions of their own Engineer (Mr. Alfred Clayton, C.E.), of Mr. E. Easton, C.E., who had a special knowledge of the wells in that area, and of Dr. Frankland, all pointed to the practicability of securing an excellent supply of water of pure quality. It was stated that the total expenditure on the works would be £25,000, and the proposal was that at least half of this amount should be locally subscribed, though Mr. Clarke said the Directors would prefer that the entire amount should be thus raised. After hearing the explanations offered, it was resolved—"That this meeting, having heard the explanation of the Herts and Essex water-works proposal, is of opinion that it is deserving the support of the inhabitants."

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Court of Common Council.

At the Meeting of the Court last Thursday, the Gas and Water Committee presented a report (see *ante*, p. 817) in reference to the letters of the Board of Trade as to obtaining an alteration in the law with respect to the recovery of penalties from the Gas Companies of the Metropolis in respect of insufficiency of illuminating power, purity, &c. They asked for authority to give the necessary notices, either separately or in conjunction with the Metropolitan Board of Works, for the introduction of a Bill in the next session of Parliament, to amend the law in accordance with the suggestions of the Board of Trade; also for authority to confer with the Metropolitan Board of Works, the Gas Referees, and The Gaslight and Coke Company thereon.

Deputy Kelday, in moving the adoption of the report, said the necessary notices had been given, and he hoped the Court would indemnify the Committee. Having done so, it did not pledge the Court to go on if otherwise advised. When the Committee gave the notices, they had reason to believe the Metropolitan Board of Works would join them in the step, and they took the precaution to give a second notice, relating to the district in which they were particularly interested. With regard to that, the Company affected had intimated their intention to assent to the proceeding. The expense likely to be incurred, even if they had to go separately, would not be heavy. The Metropolitan Board of Works would have an opportunity, on reconsideration, to come in and proceed generally with regard to other Companies in the Metropolis.

After a short discussion, the proposal was agreed to.

Metropolitan Board of Works.

At the Meeting of the Board on Friday—Sir J. M. Hogg, M.P., presiding,

Mr. Runtz moved—"That notice having been given by the Corporation of London of a Bill to amend the provisions of certain gas Acts relative to the testing of gas, so as to enable the gas to be tested in the districts in which it is consumed, and the Board of Trade having, in reply to a suggestion from this Board, promised to assist the Corporation and the Board in their action, it be referred to the Parliamentary Committee to confer with the Corporation, and to arrange the terms of a Bill in pursuance of the before-mentioned notice, to be promoted jointly by the Corporation and the Board."

Mr. Legg asked if it was in order to put this motion before rescinding the resolution of the Board, come to at their meeting on the 14th ult., not to take any action in the matter during next session of Parliament.

The Chairman having stated that the motion was in order,

Mr. Richardson seconded its adoption; and, after a short discussion, it was agreed to by 16 votes to 10.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in November:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.—As Nitrates, &c.	Ammonia.		Hardness (Clark's Scale).	
				Saline.	Organic.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	21·10	0·050	0·180	0·000	0·009	14·3	3·7
West Middlesex	21·50	0·043	0·150	0·000	0·008	14·8	4·2
Southwark and Vauxhall	22·10	0·048	0·132	0·000	0·008	14·8	3·7
Chelsea	21·00	0·055	0·144	0·000	0·008	14·3	3·7
Lambeth	21·50	0·062	0·144	0·000	0·009	13·2	3·3
Other Companies.							
Kent	28·60	0·039	0·450	0·000	0·002	18·8	7·5
New River	20·60	0·014	0·138	0·000	0·007	14·8	3·3
East London	21·50	0·031	0·135	0·000	0·007	15·4	4·2

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—namely, the Chelsea Company.

C. Meymott Tidy, M.B.

The Supply of Water at Fires.—It is not often that anything other than of an unfavourable character is allowed to appear in the daily papers in regard to the water supply of London. An exception was, however, the following letter, from an anonymous correspondent, which was published recently in the *Globe*:—"Sir,—The question of water supply that is continually coming before the London public, in a form more or less urgent, is generally looked at from a point of view from which the interests of the Shareholders are scarcely discernible. Perhaps you may spare me a line or two in your columns to call attention to an injustice to the Shareholders which does not require an Act of Parliament for its remedy—I mean the extravagant waste of water, which the Companies have to supply free of charge, at fires in the Metropolis. When an engine gets to the scene of a conflagration, the first thing that is done is to set up a canvas tank or cistern, and to allow the water to run into it from the main. The suction-pipe of the engine is then placed in this cistern to supply the pump. As a matter of fact, the water invariably runs much faster into this cistern than the engine can pump it out again, and, consequently, nearly double the quantity finds its way into the street, beyond what is thrown upon the fire. Now I recently noticed, while watching the exertions of some firemen in New York, that they did not use a cistern, but all the engines worked direct from the hydrants, so that every drop of water used passed through the pumps, and was thrown upon the fire; and I was told this system was in general use throughout America. The chief of a fire department I spoke to laughed at our system as wasteful, both of water and of the power of the engine. He informed me that in many of the engines used in London the suction is taken on the upward stroke of the piston only, and that the engine would not work if coupled direct with a hydrant, as the pump-bucket would be forced to one extremity of its stroke, and with a high water pressure would remain there. I believe, however, that an ordinary direct-acting pump, similar to some of those Captain Shaw uses, having its water pressure equal on both sides of the piston, would work well whatever head of water might be in the main. From my own observation I think the American system of coupling the fire-engines direct to the street hydrants superior to ours; and, as a Shareholder in more than one Water Company, I protest against the waste of what we are compelled by Act of Parliament to furnish, free of charge, for the benefit of the community."

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting.

The Fortieth Quarterly Meeting of this Institution was held at the Mitre Hotel, Manchester, on Saturday, Nov. 29. The attendance of members was large; and letters, apologizing for inability to be present, were read from Mr. Hunter, of Salford, and Mr. Littlewood, of Manchester. The President, Mr. Thomas Newbigging, C.E., of Manchester, occupied the chair.

The Honorary Secretary (Mr. Hunter, of Stalybridge) read the minutes of the previous meeting, which were confirmed.

Mr. Andrew Dougall, jun., was elected a member of the Institution.

Alteration of Rules.

The President: Gentlemen, our next business is to receive the Committee's report on the rules, with suggested alterations. It has been thought by the Committee and a number of the members, for some time past, that an amendment of the existing rules, and also the addition of one or two rules for better conducting the business of our Association, should be made. Accordingly, a sub-Committee was appointed to revise them. The sub-Committee met, and spent some time in carefully going through the whole of the rules, and, after they had completed the revision, their amendments were submitted to the general Committee, and unanimously approved by them. The additions and amendments are before you in the circular which has been sent to each one of you by Mr. Hunter, the Honorary Secretary, and it is for you to accept or reject them as you may decide. It was thought desirable, for instance, that the executive should be enlarged by the appointment of a Vice-President, and, on the other hand, it was considered wise to limit the executive by arranging that only two of the Past-Presidents—the Past-Presidents of the two previous years—should be members *ex officio* of the Committee. Then, again, the person selected as President is in an anomalous position. We have hitherto selected him in November to take office in February, but it was quite competent for the meeting in February to reject him and elect somebody else. That, we conceived, might possibly place him and ourselves in a difficulty, and we thought it desirable to alter that rule, so that the President might be elected in November, and have three months time to prepare his inaugural address. As we are a scientific body rather than a social club, we also thought it well to make the election of members less stringent than hitherto, so that the election of any person may not be prevented by three members blackballing him. There are a number of gentlemen, who, although their names are upon our roll of members, are in arrear with their subscriptions, some of them as much as two or three years, and we have no rule by which we can deal with them. It was, therefore, thought desirable that a rule of that kind should be adopted. I need not enumerate the other changes which are proposed to be made. The Secretary will read over each rule with the suggested alteration, and it will be put to the meeting for your sanction.

The proposed alterations and additions were then read by the Honorary Secretary, and, with some slight modifications, they were unanimously adopted.

Election of New President.

The President then rose and said: Gentlemen, I have now a very pleasant duty to perform, and one, in discharging which, I feel sure you will all be equally pleased. I have to propose to you the President of the Institution for the next year. According to the amended rules, the President is to be elected at this meeting, and to enter upon his duties at the annual meeting in February. The gentleman on whom the unanimous choice of the Committee has fallen is Mr. Carr. On personal grounds it is gratifying to me to have my friend Mr. Carr as a successor; and on general considerations, as those affecting the welfare and progress of our Institution, I believe that the choice of the executive will commend itself to the judgment of the members. It is unnecessary that I should say anything in favour of the candidature of Mr. Carr. He is one of our most active and intelligent members, and the results achieved by him in the important works of which he is the Engineer and Manager, will bear favourable comparison with the best. I beg to propose the election of Mr. William Carr, of Halifax, as President of the Manchester District Institution of Gas Engineers for the ensuing year.

Mr. Clarke said he rose with very great pleasure to second the proposition. He thought it was scarcely necessary to add much to what the President had said, but he might observe—and he was sure the members would all agree with him—that since Mr. Carr became a member of the Institution he had well earned the honour which would be conferred upon him. He had the faculty of expressing clearly and forcibly his opinions on all the questions which came before the Institution; and since he became a member of the Institution he had always freely and fully given them the benefit of his experience. He would perhaps not be so fortunate as their present President in following his predecessor, for, although, while he (Mr. Clarke) occupied the position of President, he acted to the best of his ability, he could scarcely hope that they would feel that his services were anything like those of the present President. Consequently Mr. Carr would be placed in a somewhat different position to that which Mr. Newbigging occupied when he took the chair, but he believed that Mr. Carr would do credit not only to himself, but to those who had the honour of electing him to the presidency.

The motion was carried unanimously, and

The President having congratulated Mr. Carr on his election,

Mr. Carr expressed his acknowledgment of the honour conferred upon him. He said it was a customary and formal matter to return thanks on these occasions, but he did not, he assured them, look upon it as a formal matter. He really felt gratified at the vote which had just been passed, and it would be mere affectation for him to say anything to the contrary. When it was first suggested to him that he should become President, he had considerable misgivings as to his fitness for the position. He felt that it would perhaps not be to the best interests of the Institution that he should accept the post, and he thought of one or two gentlemen, whose names he suggested to the Committee, as more capable of discharging the duties of the presidency. His only misgiving was that he should not be able to give that time, and bring that ability to bear, which had been given and displayed by the gentleman whom he was to succeed. The Committee determined, however, to stick to their proposition, and he placed himself unreservedly in their hands. He felt very proud of the honour which they had conferred upon him, and he only hoped the presidency might not suffer in his hands. He would endeavour, as far as possible, to discharge the duties of the post. Mr. Clarke had referred slightingly to his own services rendered to the Institution, but he (Mr. Carr) felt sure that a very different opinion of Mr. Clarke's services than that which he himself expressed was held by the members generally. He for one felt that Mr. Clarke laid the Institution under an obligation, such as, perhaps, no member would be privileged to do. He came into the Institution at a time of need, and brought such credit to it that his

services had not been made to look small, even compared with the presidency of Mr. Newbigging, whose ability no one would question.

PRESIDENT'S ADDRESS.

The PRESIDENT (Mr. Newbigging), after a short adjournment for luncheon, addressed the meeting as follows:—

Gentlemen,—We meet together on this occasion under somewhat altered circumstances to those which prevailed when, nine months ago, I had the honour of addressing you at length on matters pertaining to our Association, and on the position and prospects of gas enterprise in general. At that time the condition of trade throughout the country was one of almost unparalleled depression, and although there were faint signs that a reaction was on the eve of taking place, yet it required all the faith we could command, and all the experience of past times of depression that we could bring to bear, to produce anything like a settled conviction that a change was at hand. We have now before us many evidences of returning prosperity, and although trade generally is far from being in a satisfactory state, there are good grounds for believing that the tide has fairly begun to flow.

On the occasion to which I refer, I took the liberty of expressing, and endeavouring to enforce the views which I hold as to the desirability of taking advantage of seasons when work is scarce and prices low, to make the improvements and extensions in works necessary to enable them satisfactorily to meet the increased demand for gas that inevitably ensues on the return of good trade. Whether the arguments then employed were sufficient to induce any gas authorities to follow the advice or not, there can be no question that the advancing prices of raw and manufactured iron and other materials will now operate as a very convincing argument in favour of the views expressed.

To the country at large, and especially to the workers in these busy manufacturing districts where we are located, the signs of a revival in trade have an invigorating and cheering influence. In the later hours of a winter afternoon, there are few pleasanter sights in these large centres of industry than that presented by our vast manufactories when they are lighted up from cellar to attic, and the air alive with the hum and whirr of spindle and of loom; and akin to this sight is that where, in the great iron districts,

> Red tongues of flame belch from a hundred fires,
> And send their flick'ring glare athwart the sky.

These are sights to which, unfortunately, we have been long unaccustomed; but we would fain believe that once again they will become familiar objects of interest, indicative as they are of comfort and plenty to the millions of our population.

One of the first consequences of a reviving industry will be a rise in the price of coals of every description. The class of coal which is used in the production of gas will undoubtedly experience this upward movement, but not, I think, in an equal degree with the other varieties employed for steam and iron-smelting purposes. These latter are considerably below their economic value, and the first enhancement of prices will only serve to cover the losses that are being sustained by coal proprietors, notwithstanding the heavy reductions in colliers wages that have taken place of recent years. Though it is safe to anticipate that prices will rule considerably higher for some years to come, I have no apprehension that the famine rates of 1873 will ever be reached in our time. The greater economy in the use of coal, as well as the wider competition that have been the results of the so-called famine period, and the more intelligent knowledge we possess of our actual position in regard to coal supply, will operate to prevent anything like a scare in the immediate future.

There is nothing, in my opinion, in this anticipated rise in the price of coal that need unsettle the minds of gas managers. The larger demand for gas for lighting purposes, and its growing wider application in other directions, will compensate for the enhanced value of the raw material; and, as a result of the general improvement, we may also anticipate an increased demand, and consequently higher prices for coke and the other residuals of our industry.

One of the compensatory results of an increased cost in the raw material is the necessity it imposes of more skilful and careful working. It is imperative that we should extract from the coal all the valuable compounds it is capable of affording; and when the different products are obtained, we must see to their being realized as revenue with as little subsequent loss as possible. As bearing upon this question, I am every day more inclined to the opinion that there is ample room for the exercise of economy in the use of fuel in the retort-house. Our continental friends certainly appear to be ahead of us in this respect, and I feel convinced that we shall soon learn to follow the example they have set us in the conversion of coke into combustible gases, and the successful applications of these to furnace heating. In addition to the more scientific principles involved in the gas furnace, as compared with that in which coke or coals are used, it possesses the further advantage of a reduced wear and tear in the actual working of the retort-bench. I am sure that we are all highly gratified in having Mr. Webber present with us on this occasion, and we shall listen with pleasure and interest to his paper on "The Economy of Heat in Retort-Settings," having already had experience of his ability to deal with this important subject.

As bearing on the question of the growing demand for coal gas for purposes other than illumination, I may call your attention to the large business now being done in the manufacture and sale of gas-engines of different types. The improvements that have recently been effected in engines of this description have ensured the success of this valuable motor, and it is a matter gratifying to each of us to know that the manufacture of this class of engine is constantly on the increase.

There is just another subject on which I am constrained to say a word, and that is, as to the desirability of gas managers generally working up the tar and ammoniacal liquor produced in their respective works. The manufacture of sulphate of ammonia is a comparatively simple process, and the manufactured article commands a ready sale. The plant required in its production is not expensive, and the work can be done without occasioning any nuisance. Some of our long-headed members have worked up their liquor for years, and several of them the tar also, and they well know that an important addition to their annual profits can be made by so doing. At the present market price of sulphate of ammonia, it is a fact that at least 1s. per ton of coal carbonized can be realized as profit in addition to the money value of the liquor itself; so that in works producing, say, 100 million cubic feet of gas per annum, a profit of £500 can with certainty be added to the revenue.

On a dispassionate review of all the circumstances of our position, it may be said that the prospects of gas enterprise were never brighter than at this moment; and if the value of gas property is any criterion by which to judge, that opinion is fully shared by the public at large.

It would be easy to expatiate on this subject, and there are other points connected with our industry on which I could have said a good deal; but the lengthy programme that we have before us warns me that any extended remarks from the chair would be out of place on this occasion. I will, therefore, at once call on Mr. Webber to give us his paper on "The Economy of Heat in Retort-Settings."

Mr. W. H. Y. WEBBER then read the following paper—

ON THE ECONOMY OF HEAT IN RETORT-SETTINGS.

The subject which I am about to bring under your notice is of such importance in itself that I hope to be able to secure your attention in spite of any shortcomings which may mark my treatment of it. It is a subject which is constantly present in the minds of gas managers, for next to the necessity of keeping up the rate of production of gas per ton of coal, comes the problem of consuming as little fuel as possible in carbonizing.

It has been said that the carbonizers of coal labour under the disadvantage (as compared with the makers of steam-boilers) that they have no minimum as a fixed standard of comparison, by which their approach to, or falling away from theoretic perfection may be measured. And there is no doubt that this is a real inconvenience, for if the net weight of fuel required for the work of raising a given weight of coal to the proper temperature for expelling all the gas which it is capable of yielding were but determined, what a light would be thrown on the working of furnaces and retorts, and, in all probability, how differently we should regard some time-honoured usages!

For the want of something of the kind, a would-be fuel reformer is placed in the following difficulty:—Either to accept the best results of the most commonly-received system of working, as representing, if not perfection, at least something as near thereto as he may hope to arrive at; or he must cast aside all reliance upon custom and experience, and seek improvements in unheard-of directions, with the ever-present reflection before him that he has no certain knowledge of any tangible good to be obtained after all.

The tendency of most minds is to run in grooves, especially if there is no apparent reason for departing from them. Hence, although no one would assert that our most improved retort-settings are everything that can be desired, it is somewhat startling to learn that the days of the direct-acting coke furnace are numbered, and that retorts must be heated by gas if the fuel account is to be kept down to modern limits. When we learn that heating gas is made from the same material formerly burnt in the furnaces, but partially oxidized in a separate chamber, and then fully consumed in the retort-setting by an independent process, we may be excused for hesitating to embrace the new idea without some reflection on what we must have been doing so long in the old way, that we failed to discover our error. It seems, on the face of it, strange, that fuel should do more work when burnt in two distinct places, with the evident loss from the first furnace of all the effect of radiation, and utilization only of what is capable of being drawn from it through a flue, than when its radiating power and gaseous productions are both concentrated in one furnace. Yet in spite of this apparent source of loss, we are informed that with the interruption of the process, as in the generator furnaces, the saving in fuel is at least 40 per cent. on the ordinary rates. The value in gross of this saving is dwelt on with excusable pride by Mr. Oechelhäuser, who is one of the pioneers of the movement in Germany, in the last year's report of the German Continental Gas Company respecting the Warsaw works, where, as he says: "In spite of the disastrous war-taxes, amounting to 20 per cent. of the gross revenue, and the high charges for carriage of coals by railway, the saving in coke by the use of gas generator furnaces was so considerable, that at the high price at which it was sold, it was the means of preventing an otherwise unavoidable loss on the year's working."

It will be instructive to notice some of the secondary features of working retort-settings with generator furnaces, for in them, almost as much as in the central idea of substituting a gaseous for a solid fuel in the retort-stack itself, may be found some novelties.

In the first place may be noticed the low draughts with which they are worked. Experiments have been made with them when the draught was as low as 0·004 inch, and the most favourable results are obtained when the vacuum does not exceed 0·1 inch. When the draught was allowed to exceed this, so much air was invariably drawn into the furnace, through the brickwork, that the product of the generator was changed from CO into CO_2. When we remember the tall chimneys of so many of our retort-houses, we shall be justified in the opinion that few retort-furnaces work with so little draught. I am of opinion that when the chimney draught is greatly in excess of this, no arrangement of dampers in the outlets of the settings will avail to control the admission of air to the furnace. I have seen a new retort-setting in which the damper only allowed a draught outlet of 9 square inches, and the only visible inlet for air was a slit of 2½ square inches, yet the consumption of fuel was as great as in adjoining settings with fire-grate openings of nearly 2 square feet. The chimney draught was 1½ inches, and, consequently, must have drawn air through the brickwork as through a sieve.

The fact that retort-settings can be worked with heat drawn by a flue from a furnace at some distance, suggests the reflection that a good deal of the heat from an ordinary furnace goes in the same way up the chimney. It may be objected that the temperature of the main flue is not high enough to bear out this supposition, but due allowance must be made for the air which finds its way into it at all points, and so dilutes its proper contents.

Various expedients have been proposed, with the view of utilizing the waste heat of the flue in ordinary settings, either directly for the benefit of the work of the setting, by heating the air admitted to the fire, or for other purposes, but such proposals are not very hopeful while waste goes on in other ways unchecked.

Something, no doubt, is gained by stoking with hot coke, but opinions vary greatly as to the amount. My own opinion is that it is not considerable, for the real work is always done by the heated products of the fire, and these are formed as readily from cold fuel as from hot; the amount of loss caused by raising cold coke to the temperature of coke as it comes from the retorts is small, the necessary heat being drawn by radiation from the other portions of the furnace, and by contact with the brickwork, whence it can be very well spared.

A nother cause of loss in furnaces of the usual construction, and from which gas-heated settings are free, is the admission of cold air during the processes of clinkering and feeding. Suppose, for example, that from these causes a furnace-door 10 inches square is left open one hour per day. With a draught of about 2-10ths, the velocity of the entering air will be about 30 feet per second, with the damper nearly closed. Hence the quantity of air admitted during the hour will amount to 72,000 cubic feet. If it enters the furnace at 60°, and leaves the setting at 1300°, it is evident that the heat it acquires in its passage is so much robbed from the retorts, at a time, too, when they are not receiving heat to make up for it. To this quantity of air, admitted through the open door, must be added that which enters by the open fire-grate at times when there is no fuel over the bars, and which is probably even in excess of the other.

We have no means of measuring the permeability of ordinary brickwork by air under the circumstances of red or nearly white heat on one side of a wall, and cold air on the other. Some action is due to the law of diffusion, the gases inside being so much more rarefied than the atmosphere; and this proportion, whatever it may be, is, of course, independent of the amount of vacuum caused by the draught, although the effect of the latter is to intensify it to an extent of which we have probably no adequate

conception. New brickwork is, of course, subject to this action, but, it is scarcely necessary to say, to nothing like the extent of old and shaky work, crumbling and cracked in all directions, of which all that can be said is that air goes through it like water through a sieve.

Another great loss is due to radiation from, and contact of cold air with the surface of the retort-stack itself. Here we have a structure of brick-work with a coating, usually of lampblack, maintained within at a high temperature, and exposed to strong currents of air, admirably circumstanced for being cooled at all points. The conducting power of fire-brick is high, and becomes higher the nearer the material approaches vitrifaction, and may be taken as 5 units per hour per inch in thickness, for a difference between the two surfaces of 1°. If the front wall of a retort-setting 9 inches thick be exposed on its inner face to an orange-coloured heat, or 2000° Fahr., and on the outside to air at 60°, and assuming the arch to be 8 feet high and 9 feet long, the loss from both faces of the setting, and from the top, which may be taken at one-fourth the ratio of the vertical faces, will amount to 2,000,000 units in 24 hours. This is equivalent to the work done by the consumption of 4 cwt. of coke, or over 30 per cent. of the total consumption of the setting, taken at the usual average.

This loss is, of course, quite independent of the method of heating, and the only advantage offered by the use of gas fuel, in connection with any device for checking it, lies in the greater freedom from rough usage which characterizes settings without furnaces, thereby presenting greater facility for successfully coating the surface of brickwork with some material of less conducting power—such as asbestos, or similar well-known preparations—which, depending as they do for effect chiefly on the looseness of their substance, are but ill-adapted to withstand the wear and tear of an ordinary furnace front.

A certain amount of loss from radiation and contact of cold air must always exist, if only from the projecting ironwork of the retorts; but it can undoubtedly be much reduced by treatment such as I have indicated, and, with improved means of firing, progress in this direction will probably be united. With brickwork continuously coated, great diminution, or total cessation of the unwelcome intrusion of air may be also expected. I have already dwelt upon this objectionable feature, and, therefore, need only say that the saving to be effected by its abolition alone would pay for the most costly air-proof coating. But there is no reason to suppose that a really effective non-conducting material would be anything but cheap and easily applied.

There is yet one considerable drawback to the attainment of as much economy in the use of any fuel, solid or gaseous, for heating gas-retorts as is possible in the case of steam-boilers, and that is, the high temperature at which, in the former, the products of combustion must be allowed to depart.

It is considered good practice in firing boilers if the hot gases, after having done their work, pass away to the chimney at a temperature of about 550° to 600° Fahr. Even at this point, there is a good deal of work left in them, for they are still double the temperature of the water in the boiler; but considering that they left the furnace at about 1200° or more, they have parted with at least half their original usefulness by the time they are allowed to depart. This is not possible with retort furnaces. In this case it is essential that all the retorts upon which the power of the hot gases is expended, should be maintained at nearly equal temperature, and that a very high one—certainly not less than 1300°. Hence the products of combustion must be, at the point of contact with the retorts, so much hotter as to be able to maintain them at that temperature, notwithstanding the cooling action exerted by the charge within them. Consequently, if we assume that the useful work of the fuel is first devoted to raising the air necessary to support combustion, and a considerable quantity of air in excess as well, from 60° to the bright white 2500° of the furnace, and that only about 40 per cent. of this heat can be given out to the retorts, the unfavourable nature of the work for procuring high economic results becomes evident.

There is much that might be done with the effluent gases after they leave the furnace and before they are finally dismissed to the air from which they were drawn. Yet, as I have previously stated, this is a secondary consideration. Economy should not be sought in endeavouring to recover some small proportion of what has been unnecessarily lavished from the beginning. That is like the Prodigal stickling for 2½ per cent. discount on his expenditure.

I am far from wishing it to be understood that I consider regenerative furnaces, as they are constructed in Germany or France, in the light of perfect appliances for heating retorts, for they are open to objection on several grounds. But I still think they deserve particular attention as an entirely new departure, and a very promising one. I should be inclined to hope that if they were carefully studied in England they might in time be improved into quite new developments. I do not see, for instance, why the radiant heat of the generator should be neglected, for, if that is so considerable in proportion to the total value of the fuel, as it has always been stated—sometimes, indeed, being valued at as much as 50 per cent. in ordinary furnaces—it must, even in the generator, be worth consideration.

Whether with solid or gaseous fuel, self-contained in the setting or otherwise, the following prime necessities will always repay the care which ought to be devoted to them—namely, the restriction of the air admitted to the furnace strictly to the right quantity and in the proper manner; the retention of the heat evolved in its proper place, and its devotion to its own particular work; and, after that, making the best use of what surplus remains.

Discussion.

The PRESIDENT, in inviting discussion on the subject, said this was the only paper on the subject of generator furnaces which had been presented to any of the English Associations, so that credit was due to them for having introduced it.

Mr. CLARKE (Ashton-under-Lyne) observed that this was certainly a subject which deserved their serious consideration, inasmuch as it was patent to every one of them that very much fuel was consumed in heating the retorts. Of course, the question arose, Which was the best and most economical way of heating retort-settings? and upon this point Mr. Webber had thrown out one or two valuable hints. He had not, however, given them any information on the point which he (Mr. Clarke) should like to get at—viz., the quantity of air which was required to enter the bars to heat a certain number of retorts. He perfectly agreed with Mr. Webber in this—that, in having the doors open during clinkering, and having the bars exposed to atmospheric air, there was a great amount of fuel lost, inasmuch as cold air was drawn in through the open spaces, and counteracted all that the fuel might do. He should be very glad if they could arrive at some real datum as to the quantity of air which must be admitted through the bars in order to heat a certain surface.

Mr. VEEVERS (Dukinfield) noticed one point referred to in the paper—viz., that the economy of heat in generator furnaces was 40 per cent. The first time he saw one of Siemens's furnaces, he was struck in observing the great amount of heat that was required in generating the carbonic oxide to heat the retorts, yet there was a saving, and he could not account for where that great amount of heat used in generating the carbonic oxide went to. He believed attention had not been directed to these furnaces in this country simply because of the ignorance which prevailed respecting them. He should not know, if he had to put down settings on the generator principle, what plan to adopt so as to do it economically. It was a very great innovation, and there would naturally be some hesitation in adopting it. He knew that he could get results equal to those of any one else under the present system; could he be sure of better results by the new system? A paper giving some plans and particulars would be a valuable sequel to this one.

Mr. OGDEN (Blackburn) said that as long as they had no information as to the cost of the outlay in erecting the furnaces they could not tell the effect on the price of coke. Some of them were differently situated to him in respect to selling coke. He, for instance, had a contract for 4000 tons of coke at 3s. a ton, and the question was, would it pay to erect these furnaces and elevate the retorts. Mr. Webber told them there would be 40 per cent. of saving, but he did not believe any one used 40 per cent. of fuel.

The PRESIDENT explained that it was 40 per cent. of the average quantity of fuel at present used.

Mr. OGDEN said what he wanted to know was, What would be the extra cost of building the furnaces for the generators? Would it pay in the saving of fuel or coal?

Mr. BROTHERS (Chorley) was of opinion that the question was purely one of cost.

Mr. PATERSON (Rochdale) understood that there was something more than the question of saving fuel. They were to have less wear and tear.

Mr. FRASER (Bolton) believed there was a wide discrepancy between their working accounts, so far as fuel was concerned. Why there should be such discrepancy he could not understand, and anything which tended, as Mr. Webber's paper did, to throw light on the subject must be very valuable. He had always been of opinion that a great amount of heat went up the chimney, and he had been annoyed when he saw the men going about the clinkering in a slow, careless fashion. He was quite of opinion that, if they could use cleaner fuel and get rid of the clinkering, it would be a very valuable thing.

Mr. COLES (Todmorden) took particular notice of that portion of the paper relating to the admission of air into the furnaces, and he quite agreed with Mr. Webber on that point. No manager could pay too much attention to the temperature and air spaces of his furnaces, and he himself thought that a damper or drawing door in front of the retort furnace was a very valuable addition.

Mr. HARTLEY (Middleton) quite agreed with all that Mr. Webber had said as to the importance of this subject. Independently of the saving of fuel, there was the saving in wear and tear which must be taken into account, and he thought they should go in for generator furnaces.

Mr. BRADDOCK (Manchester) noticed that, amongst many other things, Mr. Webber took up the subject of what might be called quick firing—that was, not having the furnace door open longer than was actually requisite to do the work inside the furnace. This was an idea which occurred to him very forcibly some six months ago, and he then resolved to take some steps to determine what was in it. Instead of allowing the firemen to go through with the fires consecutively, he took twelve furnaces which were under the control of two dampers, put twelve men to them, in order that the whole could be done simultaneously, in perhaps a quarter of an hour. He naturally looked for a very great increase in the temperature of the retorts, but in that respect he must confess he was very greatly disappointed. No appreciable difference in the temperature could be observed, and after a lengthy trial, extending over some six weeks, that method was abandoned. He must say, however, that the observations were not quite so correct as they might have been. He might have measured the quantities of fuel, but he did not do so, and relied simply upon those who were about the furnaces. Possibly he should repeat the trial at some future date, but the result of this first experiment was what he had stated. Mr. Webber alluded to the velocity of the air current through the open furnace door. If he (Mr. Braddock) understood him aright, Mr. Webber said that the velocity was about 30 feet per second. His (Mr. Braddock's) opinion was that it was nothing like that. The velocity through the opening into the damper might be that, but it was not so great through the furnace door.

Mr. W. W. HUTCHINSON (Barnsley) agreed with previous speakers that the subject deserved very careful consideration. A considerable amount of carbonic oxide went up the chimney, and that was a source of great waste.

Mr. SAVILLE (Sowerby Bridge) was of a like opinion as to the importance of the subject, and the waste of fuel occasioned by leaving the furnace doors open. His men always clinkered in the first quarter, and the production of gas was very much less in that quarter than at any other part of the day.

Mr. CHADWICK (Oldham) wished to ask Mr. Webber one question with respect to the furnaces as they were at present constructed—viz., should the whole of the air necessary for combustion be admitted underneath the bars? He had seen air admitted over the fires to some extent. He had often seen places where the flue in connection with the main shaft had had one or two of the covers taken off, and he heard that the practice assisted the combustion of the fuel in the furnace. He did not agree with that, but he should like Mr. Webber's opinion on the subject.

Mr. MOORE (Macclesfield) thought the paper would have been more valuable if the writer had dealt a little with the question of cost. To introduce generator furnaces, they must either go in for an elevated retort-house, or for a vault underneath, and the cost of either would be very great indeed. Mr. Chadwick had mentioned the question of introducing air over the fires. He knew that Mr. Tindall, of Walsall, did that. He introduced the air at the top of the fire, and obtained very good results in this way. He was himself about to build a new retort-bench, and it would be a great advantage to him if Mr. Webber would help him to ascertain the cost and the advantages of the generator furnace system over that now in use.

Mr. EASTWOOD (Batley) said that he had recently altered the system of clinkering at his works. Instead of clinkering at the time of charging, he did so about three hours afterwards, when the coal was partly carbonized, so that the fire was got up to a very good heat again before fresh coal was put in. By this method he found the production of gas pretty equal throughout the day.

Mr. CARR (Halifax) could honestly say that this was the best paper which had been read before the Association since he became a member of it, and it was as good as most of those which came before the British Association of Gas Managers. Some of the ideas appeared to him remarkably suggestive. In the first place, as Mr. Webber pointed out, they had no practical suggestions as to the means of fixing a unit of the fuel required. Unfortunately, they suffered from the want of that fixity of unit throughout the whole of their business, and any suggestions which would help them to find the unit would be very valuable indeed. With regard to generator furnaces generally, he had long been of the opinion that they were a step in the right direction with reference to better carbonizing. When he was in Paris last year he obtained all the information he could about them at the Paris gas-works. He could not say that what he learned was suffi-

cient to induce him to adopt the same kind of furnaces—Siemens's, he believed—which they had there; but he felt that they were decidedly going in the right direction, because he had found that whatever class of material he might employ for constructing the present furnaces, the fact of there being a very much higher heat inside than outside so acted upon them that they did not last long. He had experience of that no longer since than last week, when the roof of a furnace tumbled down. This happened in the month of November, and when they considered how serious a matter this was in the depth of winter, they would see how important it was to get rid of it. In working with gas he did not think they would have that wear and tear. With the great draughts which they had, the flames impinged against the brick-work, and the consequence was, it was worn rapidly away, and appeared in some places as though it had been cut with a sharp instrument. He regretted that Mr. Webber had not had an opportunity of getting out any particulars as to cost. With regard to the question raised by one of the speakers as to where the heat used in the generator went to, it appeared to him that where they had a generator apart from the retort-setting they could surround it to such an extent that practically no heat was lost; the heat was so retained that it was practically all available. The generator furnaces could always be so arranged as to be clinkered while they were full, and in that respect they offered a very great advantage. Mr. Braddock gave them a little practical experience. He spoke about clinkering twelve furnaces at once, and he (Mr. Carr) was very considerably disappointed when he heard that no beneficial result was experienced. He thought Mr. Braddock fell into a slight mistake as to the introduction of air into the retort-setting. Mr. Webber referred more especially to the quantity than to the velocity, and although the velocity might not be so great at the entrance as at the damper, where it was 80 feet per second, the same quantity of air was going through. Mr. Moore referred to the idea of admitting hot air over the fire, and wherever a deep furnace was used he (Mr. Carr) thought the practice would be found to be a great advantage, because they could not use a deep furnace without forming a great deal of carbonic oxide, and if they admitted air, they would necessarily consume a large quantity of that carbonic oxide. It only became a question of admitting the right quantity, and in all cases where there were deep furnaces he thought the admission of hot air over the fire was desirable.

Mr. HUNTER (Stalybridge) thought that nothing required more attention than the usage of fuel. He was sorry to say that his fuel account was a very heavy one, and under the present system they were bound to use a large amount, while, if these gas generator furnaces could be employed generally, there would be a great saving in all respects. If they had the generator furnaces, there would possibly be a chance of getting one steady man after pay-day to attend to them, and one great difficulty in that direction would be removed. He should be glad to see some practical suggestions as to the form in which they could be adopted.

The PRESIDENT thought the paper which Mr. Webber had read was a very suggestive one, and one that would occupy very much of their time until the next quarterly meeting, if they were to thoroughly appreciate it and understand its value. It had been objected by some of those who had spoken, that Mr. Webber had not given them the cost of erecting the generator furnaces; but it must be remembered that this was the first paper which they had had on the subject, and before they began erecting generator furnaces let them become thoroughly conversant with the theory of them. Let them understand that they were going to produce a combustible gas, and that this gas, mixed with its proper proportion of air, was employed in heating the setting. If Mr. Webber had omitted anything from his paper, it was entirely his (the President's) fault. He charged him that it must be short, and complete as far as it went. That suggestion Mr. Webber had carried out, and they would all, he was sure, be pleased to see the paper in print in their proceedings. Reference had been made to Mr. Tindall's furnace. It should be stated that this was not a coke furnace, but one for the consumption of coal, and a portion of the air must necessarily be admitted at the surface of the coal in order that the gases produced might be consumed; but even in a coke furnace, if it was a very deep furnace, there ought to be a certain quantity of air admitted at the top to consume the carbonic oxide. They were all familiar with the appearance of flame at the top of some chimneys. That was simply the hot carbonic oxide escaping and firing on coming in contact with the air, and the proper consumption of it in the right place was a matter of great importance to gas managers. On the question of generator furnaces, a strange indifference had been manifested by gas engineers in this country, but they were now gradually becoming alive to their advantages. From a theoretical point of view, they had everything to recommend them, and their continental friends had proved their value in practical use. The saving, not only in fuel, but in wear and tear, that would result from their adoption was too patent to need dwelling upon, and their introduction into the gas-works of this country was only a question of time. There was, perhaps, not the same inducement to introduce them in England as there was on the Continent, because fuel was comparatively cheap. Still, they ought to be prepared to take every advantage of the progress of science, and conduct their works in a scientific way. They had been too much in the habit of pursuing the beaten track—of "letting well alone," forgetting that if they always continued to "rest and be thankful," without exercising a wise discretion, they would completely block the way of all progress. As bearing on the subject of the quantity of fuel required, the question of more or less brickwork in the retort-settings suggested itself. He did not think it made much difference whether they had a large or a small quantity—that was his opinion so far as the consumption of fuel was concerned—but let them be careful to support their retorts, so that they might satisfactorily bear the wear and tear of working during the time they were expected to last. But there were far more important questions requiring attention than that of the quantity of brickwork in settings. One of these was the question of the regulation of the draught, and long chimneys on retort-houses were, in his opinion, utterly to be condemned. No greater mistake was made than the erecting of long chimneys, because, by their use, in spite of dampers, there was excessive draught during nine months of the year, and in the other three months there was not draught enough. It was far better to have a number of small chimneys with good wide openings through them; the economy was greater, and there were advantages in many other respects.

Mr. WEBBER, replying on some of the points raised, said he had no idea whatever of going into particulars of the cost of generator furnaces as compared with ordinary furnaces, or anything of that kind, because it simply meant a volume in itself. There were about as many different sorts of generator furnaces as there were retort-settings, and until the principle of the thing, and some of its advantages, were understood, he should have thought it scarcely necessary to go into details of the cost. Besides, they could hardly get it if they wished. These furnaces were by no means in a perfect state. Experiments were constantly going on, and there was hardly a gas engineer on the Continent who had not a generator of his own by which he swore. They were endeavouring to reduce the wear and tear and the initial cost of construction, and he did not think they could easily say at the present time what a thoroughly good and reliable generator furnace could be constructed for. The advisability of introducing the generator furnace was a matter entirely for local consideration. It was very evident that it would not be worth while to go to any great expense where the cost of the material which would be saved was low—certainly not so much as where the cost of the material was very high. In some places coke fetched a good price, and was sold as soon as made. In these places the advisability of adopting plans for saving fuel was more pressing than where coke was of nominal value. Mr. Clarke asked for information as to the proportion of air which ought to pass through the bars. That was really a question of the amount of coke consumed, and, as he had endeavoured to point out, the amount of coke consumed was not by any means always considered. Different settings in different parts of the retort-house would consume very different quantities. He thought a great deal depended upon the draught—more perhaps than upon anything else—and he quite agreed with the remarks of the President as to the importance of the draught in the chimney. The remarks of Mr. Veevers as to the loss of heat in generator furnaces were worthy of consideration, though the fact was it had been proved that there was no waste of heat such as might be supposed to arise. Carbonic oxide was not generally reckoned to be so valuable as the fuel, and the only thing was that the carbonic oxide in this case was not formed in the way with which they were familiar, by the admission of air in insufficient quantity, as in a bad draught, which caused the formation of carbonic oxide, because the air admitted was not enough to convert the fuel into carbonic acid. In the generator furnace the combustion was perfect. The coke was consumed into carbonic acid, and this gas took up a further proportion of carbon, and became reconverted into carbonic oxide. It was first carbonic acid, and then it was reformed into carbonic oxide. They must have a certain amount of heat to form this gas, but the gas when it left the generator was hotter than that. Still he had the opinion himself that there was some loss by radiation which might be better utilized directly on the retorts themselves, if they could possibly measure it. Of course, as Mr. Paterson said, the saving in wear and tear was very important. Mr. Carr would bear him out that the saving in Paris was very great. Mr. Fraser had drawn attention to the discrepancy in ordinary working. They heard that in one place the consumption of fuel was 37 per cent., and in another place it was only 25 per cent., while the generator furnace was supposed to consume only from 12 to 15 per cent of fuel. If they took it at 12 per cent., it was a saving of 50 per cent. as compared with a consumption of 25 per cent., while, as compared with a consumption of 35 or 37 per cent., there was a saving of 66 per cent. Mr. Coles advocated the use of dampers. His opinion was that they could not for five minutes together accurately regulate the quantity of air. He had had practical experience of it, and had endeavoured to construct a furnace in which he could do so, but he was floored by this difficulty. He had gone into the idea of accurately proportioning the fire-grate area to the area required to consume a certain proportion of coke per hour, but found he could not do it at all, because, directly the fire began to burn, a film of clinkering began to form, and the whole thing was upset. As he had said in his paper, the admission of air through an opening of 2½ square inches was as large as through an opening 2 feet wide. Mr. Braddock did not believe in the velocity of the air, but as long as the draught was maintained in the setting, the quantity must be the same. Throwing open the fire-doors might let in such a rush of air that the velocity might afterwards be checked. The quantity would be just the same, but in that case the velocity would be less; it would only go in through a bigger hole. As to the admission of air above the fire, the advantage of that was no doubt considerable, where they had a very deep furnace, and the fire-door and brickwork were perfectly air-tight; but the depth of the fire over the bars was not usually so great as to require special provision, and particularly when they considered that the furnace-doors were not generally in such perfect condition, and the brickwork, owing to the clinkering and the dashing about of water, was in such a state as to allow as much air to get in as was required. In conclusion, he said he simply intended his paper to be suggestive, and if it had proved to be that it was quite as much as he hoped for.

A vote of thanks was, on the motion of the PRESIDENT, seconded by Mr. HUNTER, the Honorary Secretary, accorded to Mr. Webber for his paper.

(*To be continued.*)

AMERICAN GASLIGHT ASSOCIATION.

(*Continued from p.* 781.)

The *American Gaslight Journal*, of the 17th ult., to hand last week, contains a second instalment of the "Official Report" of the Proceedings at the Seventh Annual Meeting of the above-named Association.

The report of the Committee on the Nomination of Officers was presented and agreed to, the following being those proposed and unanimously elected:—

President.—Mr. W. H. Price, Cleveland, Ohio.

Vice-Presidents.

Mr. J. P. Harbison, Hartford, Conn.
General A Hickenlooper, Cincinnati, Ohio.
Mr. G. A. M'Ilhenny, Washington, D.C.

Secretary and Treasurer.—Mr. W. H. White, Brooklyn, N.Y.

Finance Committee.

Mr. J. S. Chambers, Trenton, N.J. | Mr. T. Forstall, New Orleans, La.
Mr. A. B. Slater, Providence, R.I.

Executive Committee.

Mr. P. T. Burtis, Chicago, Ill. | Mr. F.C. Sherman, New Haven, Con.
Mr. H. Cartwright, Philadelphia, Pa. | Mr. J. W. Starr, Richmond, Ind.
Mr. G. S. Hookey, Augusta, Ga. | Mr. A. C. Wood, Syracuse, N.Y.

On the motion of Captain WHITE, a vote of thanks was passed to the retiring officers—the ex-President (General Charles Roome), and ex-Secretary and Treasurer (Mr. Charles Nettleton), who had declined to be re-elected, being specially mentioned. Both gentlemen's services, in connection with the management of the affairs of the Association during the last five years, were highly eulogized.

Mr. NETTLETON and Mr. NEAL having responded to the vote, the meeting adjourned for luncheon. On re-assembling,

A paper by Mr. F. C. SHERMAN (New Haven) was read by Major Dresser, Editor of the *American Gaslight Journal*. It was as follows:—

THE RELATIONS OF MUNICIPALITIES TO GAS COMPANIES.

Within the past few years there have arisen in this country a class of individuals who wish to hurry up the millennium by attacking corporations of a semi-public nature. This feeling manifested itself in the labour riots of 1876, and is at present extremely popular in California. These outbursts are always originated by those who see a short road to wealth by dividing and distributing the savings of others. For political or other reasons, many respectable people join hands with them, and the consequence is that we already hear of a struggle between labour and capital. That gas companies have received no little attention from these reformers, aided by many who bear honest convictions that a better state of affairs

could be brought about, is evidenced by the slightest perusal of the daily press. Their absurd and foolish statements meet with a ready credence, as is demonstrated by the sympathy and aid extended to all attempts to establish rival companies.

Statistics abundantly prove that competition in the supply of such an article as illuminating gas cannot be sustained. Wherever it has been tried, evils of a nature to more than counterbalance its good qualities have arisen. It has been necessary either to district the territory or absorb it. The people ultimately have to pay for the increased outlay necessary to cover the interest on two or more sets of mains and works, together with the watered capital. But few American cities are large enough to try the experiment; and, if they were, the experience of the largest cities of the Old World would not sanction the attempt. It has been abandoned in every instance where tried across the Atlantic, the two most notable examples of which are to be found in London and Paris. At one time there were 14 Companies in London. In 1860 each one was assigned a district, and since then, by amalgamation, the number has been reduced to five. Of the several Companies which at one time existed in Paris, but one remains.

The system of rivalry in the production of illuminating gas has been fully tried in New York state, under the fostering influence of the Legislature. The result has been that, although two or more Companies exist in nearly all the principal cities of that state, the cost to gas consumers exceeds that in cities which have but one company to support. It is safe to estimate that more than double the amount of capital necessary to transact the business is invested in it in New York state, thus weighing it down in such a manner as to prevent its true development and growth.

To add to the difficulties, the unfriendly treatment which most companies receive from municipal corporations should be noticed. In most places they are barely tolerated; denied their rights in the streets; their mains and services injured, and leakage increased. Again, in the matter of lighting the streets, the companies are crowded in the price below a living rate, and constant carping is indulged in, both as to the quantity and quality of the gas furnished.

A partial remedy for this state of affairs can be found in giving greater publicity in regard to our business, and leaving the intelligent citizen to see for himself the hollowness of the arguments in favour of competing companies. To the veil with which we have so carefully surrounded ourselves in the past is in a measure due the opposition which we are now encountering. It has begotten suspicion and jealousy on the part of our consumers. It has led many to believe that our profits are too great to stand public scrutiny. The future safety of our investments in gas manufacture lies in taking the public into our confidence. Our business is honourable and useful, and we have nothing that ought to be concealed. With very few exceptions, the customers of gas companies have been honourably dealt with, and the profits have not been more than the risks warranted.

In England, where the whole question has been thoroughly investigated, the companies are allowed by law 10 per cent. dividends. An examination of the business in this country would reveal the fact that a 10 per cent. dividend is not realized. The uncertainty that hangs over gas investments is an outgrowth of this hostility, engendered by ignorance of the business. Where a company is prosperous, a constant effort is necessary to keep out opposition, and is often attended with great expense. From its very nature, it is necessary that the business should be a monopoly, but an enlightened self-interest demands that it be one regulated by law. Not only should our gas be subjected to inspection, but also our investments, our operating expenses, and profits. This would do away with many of the complaints of our consumers, and ensure us from competition. I am satisfied that we must come to this eventually in order to escape ruinous competition, and the burdening of the public with the support of unnecessary capital.

Some of you may deny that we, the managers, have any interest in this subject; but self-interest, if no higher motive, ought to make each of us use his individual influence with his own company in seeking to bring about, in a quiet way, what may eventually be forced upon us in a burdensome form.

Mr. Littlehales (Hamilton, Ontario, Canada) said it seemed to him that the paper struck the key-note of the position in which gas companies stand. There was a great demand for a reduction in the price of gas all over the country, and this could only be complied with by modifying the system heretofore adopted in the conduct of gas companies. He then explained the manner in which, in England, further powers are obtained by gas companies—only after an inquiry before a Parliamentary Committee, the result being, he said, that raising of excessive capital was checked, and hence gas was sold at a cheaper rate in England than anywhere else, while the capital invested was perfectly secure. If such a system could be adopted in America, there would be some inducement for gas companies to lower their price and restrict their capital outlay. Until there was some uniformity in legislation, however, it seemed to him, such a reduction in price would never be reached as might be effected if proper legislative enactments were obtained.

Major Dresser said in many towns there was, nominally, too much capital invested in the gas undertakings, even where there was but one company existing in the place; and it seemed to him that the Association could not render better service to the public than by putting their heads together, and seeing if there was not some way by which the capital represented by the gas-making interests of the country could be reduced to a reasonable basis, and to a just proportion to the amount of the business done and the value of the plant employed. When the point was reached that a gas company did not have to add a dollar to the cost of every 1000 feet of gas sold in order to pay a 10 per cent. dividend—or, in other words, to a point where the capital of the company was reduced within reasonable limits—a reduction in the charge for gas would be practicable and profitable. The trouble about the matter was that those who might seek to bring about such a change would encounter an opposition that would be very hard to overcome; for when it was demonstrated to the satisfaction of the public and to everybody else, that a gas company was not making exorbitant profits, no one would put more money into it. He thought this was a very important point, and one that deserved to be most carefully considered by the Association.

Mr. Coggshall (Fitchburg, Mass.) thought that this matter really rested with the gas companies themselves. If stockholders in the companies would be willing to reduce their capital, and be satisfied with a reasonable dividend of 8 or 10 per cent., with taxes paid, the solution of the difficulty would be reached. Opposition companies would not go to any place, such as Lowell, where gas was sold, as it was there, at 1·80 dols. per 1000 feet. If holders of stock in the companies could be brought to accept the situation, and manufacture gas as cheaply as it could be made, and sell it at as low a price as possible, there would be no danger of competition.

Mr. Stedman (Newport, R.I.) said it seemed the matter after all came down to the old question about "belling the cat." Who would have the temerity to go to gas stockholders and say to them, "You have too much capital. If you are willing to reduce the amount of your stock 33 per cent., and receive 8 or 10 per cent. dividends on the balance, over and above taxes, we can sell gas low." A good many New England gas companies were in the situation of having a very large plant put up by contractors who came in the town for the purpose of making a pile of money. The works were put up, say, at a cost of 60,000 dols., the builders receiving the stock of the company to the amount of 120,000, 130,000, or 150,000 dols., and a large amount of stock would be issued. Then they would step off, and would leave the stockholders to work out the problem of how to manufacture gas, and how to sell it, so as to make a dividend on the large amount of capital invested. Having found themselves in a position of this kind, they put in a little water, so that the capital really represented a very large amount per 1000 feet of gas sold. In some statistics of several of the New England gas companies, which had recently been collected, the capital stock, per 1000 feet of gas sold annually, in one case was as low as 1·90 dols., and in another as high as 29 dols., the average being a little under 9 dols. It was brought down to this low average on account of one or two large companies having a small average, as if the two largest of the companies were taken out of account, the average would be between 14 and 15 dols. He believed the time would come when these matters would be regulated by the Legislature, very much as in England; but when it did come to that, and books and accounts were inspected, it would probably lead to a considerable amount of criticism. People would very naturally say, "What does this 50,000 dols. represent? Here is a statement of your books that a certain amount was divided among your stockholders. Does that represent 25,000 dols. or 50,000 dols. actually put into the company to enable them to enhance their productive power, and to decrease the cost of production; or does it represent a fictitious value—something that was not actually put in?" Those were criticisms and questions that would undoubtedly be made and asked, were their books and accounts open to the public. He believed that it would be of great advantage to gas companies if they could satisfy the public that they were dealing fairly and honestly with them. But when gas companies were in the position he had referred to, where they had watered their stock, and where their stock did not represent the actual value of the plant, and did not represent money actually put in, there would, of course, be some difficulty about having the matter made public, and some natural repugnance to opening books for the inspection of the public. But who would have the temerity to bell the cat? Who would have the temerity to go to stockholders and say: "This dividend, this money that was given to you, we could hardly afford to give. If you will adjust the amount of your stock, and put it upon a fair and reasonable basis, and establish a just proportion between the amount of capital stock and the value of your plant, we shall then be able to sell gas cheap, and pay 8 or 10 per cent. dividend upon the capital thus reduced." If stockholders could be brought to look at the matter in this light, he thought there would be little trouble; and, after the change was made, stockholders probably, and consumers certainly, would be much better satisfied. The best interests of gas companies would be served if the public were thoroughly convinced that they were fairly, honestly, and justly dealt with; and that the cost of producing gas was as low as it could reasonably be made, and that it was sold for only a fair margin of profit.

Mr. Harrison (Hartford, Conn.) said he agreed in part with what Mr. Sherman had said, and only in part. He thought that a certain amount of publicity in regard to a gas company's affairs was right and proper, so far as the public were concerned—the public had rights which gas companies were bound to respect; but there was a limit to those rights. He did not think the public were entitled to know the details of the business any more than they were informed, or ought to be informed, of the details of any manufacturing company's business. The great difficulty gas companies laboured under in regard to threatened opposition was due to themselves, as they had not, in a majority of cases, dealt fairly with the public. A company who had their capital stock watered from 40 to 50 per cent., and expected the public to pay a dividend of 10 or 12 per cent. on that watered stock, was not treating their consumers rightly, and threatened opposition would not hurt them, but would bring them to their senses. In Hartford they conducted their business fairly and legitimately. Their capital stock represented a *bonâ fide* investment; and at 2 dols. per 1000 feet they were enabled to pay a dividend which satisfied every stockholder in the Company. Not one had expressed dissatisfaction, and they were enabled to do this because they had not an inflated capital. He did not believe that the trouble was all with the municipalities. He thought the gas companies were to blame in many instances for the position they held to the municipality. In his experience it had worked well for the Company to take interest themselves in city affairs, so that they had some voice in the matter of legislation. He had found it had been of great benefit to them to have some of the stockholders members of the Common Council or the Board of Aldermen. It had a healthful influence in the shaping of legislation. He thought that managers of gas companies ought to have influence enough with their boards of directors (who were generally not intimately acquainted with the practical details of gas manufacture) to be able to fix a price that the public would be satisfied with. For if the consumption of gas was made popular, it increased; and to make the consumption of gas popular, and bring about a proper relation between the gas companies and the public, it would not do to charge a high price for poor management, and interest and dividend on an inflated capital, or anything of that kind. He did not, therefore, think that the Association, or any association, could fix upon a rule of action that would reduce the capital stock of gas companies. The only way in which that could be done was by those serving in companies who had an inflated capital, and knew it, to satisfy their directors and stockholders that the time had come when they could not expect large dividends on paper, or what they held as paper, which did not represent anything that they put into the business. He thought this was the great trouble with individual companies as a general thing, and it was the very root of the evil of threatened opposition.

Mr. Nettleton said the paper was on the relation of municipalities to gas companies; but the discussion had wandered from that point to the gist of the matter—self-preservation against competition—which was the real point of interest. How should a gas manager protect himself against competition? He had to do that for himself, which was better than relying upon legislation, better than relying upon his directors, better than relying upon any such influence. He could do it by qualifying himself to carry on his business, and by so carrying on his business as to be able to make gas cheaper, and sell it cheaper than anybody who might come into his district and try to do it. With a perfect understanding of his business, he (Mr. Nettleton) would also include the capacity to be on good terms with his consumers and the community, to be able to satisfy the community that he worked for their interest, and gave them the best and cheapest gas he could. A gas manager must be able to do a little better for the same money, or for a little less money, than any other man.

Mr. M'Ilhenny said it seemed to him there never would be any compromise between the maker and the buyer of gas. He did not think that price had anything to do with it, as, no matter how cheap gas was sold, or however good an article was made, the community would always suspect the company of fraudulent transactions. As to opposition, in his judgment, the prolific cause of it in America was the cheapness of oil, which, by giving countenance to the designs of those who

had oil gas processes to substitute for coal gas manufacture, led the Legislature to sanction such processes, in the belief that they would result in the good of the community, instead of, as they did in many cases, harm to all concerned. He believed that no matter what the charge made for gas was—whether 2 dols. or 50 cents per 1000 feet—gas companies would always be denounced as frauds. Even in Europe, where gas was sold so cheaply, the circumstances had not changed, as he could answer from his experience during a recent visit. And so it would be as long as there was being sold an article without any definite cost, and as long as consumers did not know, until the end of a month, what they would have to pay. They forgot meanwhile how they were burning gas; and when the bills came in were disappointed, and being so, were discontented, and then grumbled. To some extent, the dissatisfaction of the community might be overcome, or, at least, modified, if each individual consumer could be reached and shown that what was being done was right and fair. If he could be made to see that only a 10 per cent. dividend was being made, he would not think that that was too much; but still he would all the while have a feeling of doubt in his mind. He must have a cause for grumbling; but need not have a ground of complaint. As he (Mr. M'Ilhenny) had said before, he did not think there would ever be a compromise between the consumer and the seller of gas. In the first place, many people had no faith in the meter; they said it could be manipulated, and was never correct. Then, secondly, they never knew what their gas bills were going to be until they received them. Every man who was circumspect in his expenditure was obliged to consider the amount of his coal bill and his butcher's bill, and regulate his domestic affairs accordingly. It was not so with his gas bill, which, when it came in at the end of the month, and, through excessive consumption on dark days and bad weather, was more than he supposed it would be, would be sure to cause a grumble. There seemed to be no kind of device that could be universally adopted to establish satisfactory relations between gas companies and the public, because the circumstances were different in nearly every place. As to stopping opposition, he did not think it made any difference what price was charged for gas—whether 50 cents or 2 dols. per 1000 feet. Opposition would not be stopped until it became so obnoxious to the community that they stopped it themselves.

Mr. HARRISON said he disagreed with Mr. M'Ilhenny when he stated that it made no difference what the price of gas was in regard to threatened opposition. Parties who were at the present time making the most earnest efforts to get into various places in Connecticut, had said to managers of gas-works there that in a place where gas was sold as low as 2 dols. per 1000 feet, it was of no use for them to try to do anything; but where the charge for gas was more than this, they considered that was the place for them to try to get into. This assertion was made by those who were trying to establish opposition in his state.

Mr. COGGSHALL believed that the greatest enemy American gas companies had to contend with was the low price of oil. In the city of Lowell a short time ago they were selling gas at 1·80 dols., and he only saw in the streets one store lighted with oil. This showed that there was virtue in selling gas at a low price.

The PRESIDENT said there was a great deal of force in the views which Mr. M'Ilhenny had presented; but there was another view of it that was somewhat more favourable. He (the President) readily believed that it was exceedingly difficult to satisfy the people of a large city like Washington, even if they were fairly dealt by. But he thought the gas business could be conducted in such a way as to satisfy the moral power of the community. The moral power of the community was exercised, not by the masses, but by the leading citizens. If one could satisfy the leading influences in the community—the manufacturers, the merchants, the bankers, and the business men—that what was right to the community was being done, a long distance was gone towards success, a great thing being to have the moral support of the community in any business, and this was especially so—in fact, indispensable—in the gas business. Almost everybody had sense enough to know that a gas company ought to make a 10 per cent. dividend. Gas-making was a risky business; it was liable to be destroyed by the introduction of other agencies. The business had already been very much injured by the introduction of petroleum, and almost every one was willing to concede that gas companies ought to make 10 per cent. upon their investments. A millionaire in the town he represented, who had not a dollar invested in gas stock, said he thought a gas company ought to make 15 per cent. He said: "I would not have gas stock unless it paid 15 per cent." That was going a little farther than he (the President) would go, but every gas company ought to pay as much as 10 per cent. The matter of the establishment of opposition companies was one of those difficult questions the dealing with which nobody could understand, unless he looked at it in the light of personal experience. Men had gone into communities and constructed works which cost three times more than they ought to have cost, and had issued stock or bonds, and sold them and pocketed the money, and gone away and left the gas companies with plant that was not worth the ground on which it stood—miserable, good-for-nothing works. What were the stockholders to do? They knew nothing about the gas business. When people demanded cheap gas in such a community, the stockholders said, "Here is a plant that cost us so much, and in order to pay interest upon the money invested, and a dividend upon our stock, we have to charge a high price for gas." The reason why, in a great many places, gas, although sold at a low price, would not pay anything upon the stock was because just such a swindle as that to which he had referred lay at the bottom of the whole thing. There were very loose laws all through the United States in regard to the issue of stock. Companies could water their stock almost as they pleased. He did not say they had done it, although there was no doubt that such had been the case in the history of some gas companies that might be named. To prevent this, what was wanted was, where small gas companies were thus situated, a good local enactment—something like the English ones—which would put these small companies upon a safe basis. If there was a law by which the matter might be inquired into, and by which it might be decided how much capital such companies ought to have, and if they were permitted by law to make a certain percentage of profit on that capital, it would have a tendency to remedy the difficulties to a great extent. The companies would, therefore, as it were, be justified before the community in charging a fair price for their gas. He thought what they had to do was to seek, by every means in their power, to place gas companies on a good moral footing, and get the moral support and influence of the community by making gas as cheaply as possible, and selling it at as low a price as could be charged, so as to secure a decent dividend for the stockholders. If they did that, he thought the community would support them, and there would not be much to fear from the establishment of opposition companies, or from the efforts of blackmailers.

A vote of thanks was then passed to Mr. Sherman for his paper.

(To be continued.)

RETFORD CORPORATION WATER SUPPLY.—At the last meeting of the Retford Town Council it was resolved that, as the Urban Sanitary Authority, they would apply to the Local Government Board for their sanction to the raising of a loan amounting to £12,000, for carrying out the Corporation water-works scheme.

EXTENSION OF STOREAGE AT THE CHARTERED GAS COMPANY'S WORKS, KING'S CROSS.

Additional gasholder accommodation being required at these works, which previous to the amalgamation with The Gaslight and Coke Company belonged to the late Imperial Gas Company, and no land being available for new tanks, the Engineer of the works, Mr. John Clark, has had recourse to telescoping the three holders already in use. This is now being carried out, under his direction, by Messrs. Westwood and Wrights, of Dudley, and the difficulties of the operation are very considerable.

Two of the present holders were erected by the late Mr. D. Methven, the other by the present Engineer, and they are planted quite close together, on two sides immediately abutting a road leading to the Great Northern Goods Station, and the other on the Midland Railway Company's main line, where trains are quickly passing day and night. The tank walls also intersect each other, so that it is impossible to get shear legs round the outside of the columns, as is generally done. The heavy castings employed in heightening the columns are therefore lifted, by means of a very fine pair of shear legs, upwards of 140 feet high, travelling round the tops of the present holders, the legs weighing over 20 tons. Then, again, it is necessary to keep the holders in use, so that everything has to be done piecemeal.

The heightening of the columns is now being proceeded with, and next spring, as opportunity occurs, it is proposed to complete the work. Each holder when finished will rise about 115 feet, in two lifts, and the telescoping of them will increase the storeage capacity of the holders to about 4 million feet.

So far all concerned may be congratulated that, notwithstanding the difficult and dangerous nature of the task, not the slightest accident has occurred to any one employed.

ROTHERHAM CORPORATION GAS SUPPLY.

At the Meeting of the Rotherham Town Council on Wednesday last—the MAYOR (Mr. W. Harrison) in the chair—the minutes of the Gas Committee were presented. They contained a recommendation from the Gas Committee that the Council should appropriate the accumulated profits of the gas-works department, as follows:—To the district-fund account, £1671 7s. 8d.; water-works, £2753 9s. 8d.; and the balance of £976 8s. 2d. to a contingent-fund—total, £5401 5s. 6d.

In calling attention to this subject, Mr. NEWSUM asked whether the Council did not think the time had arrived when the public should have some benefit in the reduction of the price paid by consumers for gas. Having compared other towns in the same position as Rotherham with regard to size, and facilities for procuring coal and disposing of residual products, he said he thought something should be done in this respect. He was quite aware that the present proposal would simply result in "robbing Peter to pay Paul," but he was not sure that it was not best that each department should be made to bear its own responsibilities. If the general district-rate and the water-rate were not adequate to meet the expenditure under their different heads, by all means let them be increased. Besides, he believed the Council had the power of making what was known as an improvement water-rate. He considered that, unless more reasons could be adduced than he knew of, the recommendation should be sent back to the Committee, or the Council be called together specially to discuss it.

Mr. WALKER also objected to the proposed appropriation of the profits, on the ground of its injustice. He could not see why the price of gas should not be lowered from 3s. 3d. per 1000 feet, when they could get coal at 8s. per ton, seeing that Sheffield only charged 2s. 6d. per 1000 feet, and paid 11s. for coal. At Plymouth also, he said, the rate was 2s. 6d. per 1000 feet, although 22s. 6d. per ton had to be paid for coal. He pointed out that in the borough there were large firms who made their own gas, and said they would have less to pay on other rates because of the proposed appropriation, and such a thing would be unfair to ordinary consumers. He also thought that the proposal would discourage the gas-works officials in trying to work economically when they saw the profits absorbed in this fashion. He had spoken to other ratepayers on the subject, and they were somewhat sore with regard to it.

Alderman KELSEY pointed out that the money proposed to be appropriated was profit which had been realized, and it could not be taken to make a reduction in the price of gas. At the Committee meeting, when the matter was under consideration, the Town Clerk ruled that the profits could be appropriated to the relief of the rates. In Manchester a profit of £90,000 had been made, and he took it that this money would be devoted in some such way as the Gas Committee of Rotherham proposed to appropriate the amount now in question. The profits on the gas undertaking last year only amounted to £600 or £700, and the sum now in hand was not the profit of one, but of several years. He asked them to bear in mind that if a deficit occurred on the undertaking, non-consumers would have to bear their share, and it was only fair they should have some benefit from the profits when there were any. The subject was a fair matter for discussion, and he should not be one to regularly appropriate enormous profits in the way that they had been dealt with in this case. Moreover, the gas profits should not be taken to decrease the liabilities on the water-works account, when a good part of those liabilities was created by works which were intended to meet future as well as present requirements, and which, therefore, should not all be charged on the present rates.

Mr. WRAGG said that Glossop paid 5s. 2d., and Barnsley rather more than Rotherham per 1000 feet for gas. If the proposed appropriation were not approved, it would cause an increase of 4d. in the pound on the general district-rate, and bring the water-rate up to 7d. in the pound; and he would by far prefer the arrangement submitted for the consideration of the Council.

Mr. GUMMER did not think the Council were getting as much as they ought from the gas undertaking, and considered the proposed scheme was such as to cause the officials to do the best they could for the Corporation. It might also encourage other Committees to be extravagant, because they would see that they had other money to fall back upon at the year's end.

Alderman HABERSHON (the Chairman of the Gas Committee) admitted that no doubt very soon a reduction in the price of gas would have to take place; but he said also that the contingent-fund must be enlarged in future. The Act of Parliament gave them power to make the contingent-fund as large as 10 per cent. of the capital of the entire undertaking. He did not think so much deficiency would occur on the water-works account again, and with an increased storeage accommodation at the gas-works, he should be much disappointed if they had not considerable profit this year, which would make it unjustifiable if some reduction in the price of gas was not decided upon.

The recommendation of the Committee was adopted.

MR. C. A. CASE was, on Thursday last, elected Secretary of the Maidstone Water-Works Company, a post held for many years by his late father.

THE ST. JOHN PATENT GAS-PURIFIER.

The specification of a patent for an improvement in this apparatus has just been issued; and, as it has only quite recently been decided to adopt the machine at the Rochdale Corporation Gas-Works, a description of this, its latest form, will be of interest to many of our readers.

The patent (No. 1733, May 1, 1879) is granted to Roswell Sabine Ripley, being a communication from William Henry St. John, of Bay Shore, Long Island, U.S.A., and relates to improvements in the process or apparatus for which a patent was taken out by Mr. St. John in 1873—No. 2527. The specification states: "The gas is caused to come into intimate contact with the liquid brought over from the hydraulic main in a series of chambers or boxes that are constantly supplied. This liquid effects a complete removal of the tar, dissolving the naphthaline; it also removes a portion of the sulphur and other impurities; at the same time it gives to the gas a much higher illuminating power. Prior, however, to passing the gas through the series of boxes which are supplied with hydraulic main liquor, it is advantageous to pass it through two other similar series of boxes; the first series containing an alkaline solution, and the second series water or a diluted alkali. These arrangements take the place of the usual washing and other condensing processes or operations."

The apparatus consists of series of chambers or boxes supplied with dip-tubes which subdivide the volume of gas. Immediately below the dip-tubes is placed a wire gauze, which also subdivides the volume of the gas. This wire gauze is placed in every box, and is always submerged in the liquid immediately at the bottom of the tubes.

The alkaline solution, with which the first series of boxes is charged, consists by preference of an ammoniacal liquor obtained by purifying and rendering caustic a portion of the liquor drawn from the hydraulic main. The water or weak liquor with which the second series of boxes is charged serves to absorb any ammonia which may be carried forward with the gas. The third series of boxes, as already stated, is supplied with liquor drawn direct from the hydraulic main.

By the passage of the gas through these three successive series of boxes, the tar with the naphthaline is said to be completely extracted, as well as a large quantity of the sulphur compounds. The gas, it is stated, also absorbs from the hydraulic main liquor the light hydrocarbons, which increase its illuminating power from one to two candles or more.

The apparatus further comprises vertical pipes resting upon boxes, which serve the purpose of condensing the aqueous vapour in the gas held in suspension at this point. A spray of ammoniacal liquor is introduced into them, to arrest the ammonia as well as the sulphur compounds. These vertical pipes are supplied with a series of corrugated plates, which are so placed as to subdivide the volume of gas into thin sheets, and by this process the ammonia can be extracted.

The boxes of each series are connected by an equalizing pipe, which maintains uniformity in the level of the liquid throughout the series. A cock also in each case regulates the depth to which the dip-tubes are immersed.

"When the apparatus is used, the volume of gas produced from a given amount of coal can," the specification states, "be materially increased by a prolonged distillation of the coal, or by introducing into the retorts, for a period after the coal has been converted into coke, a jet of steam, which it would be preferable to have superheated. The attenuated gas produced by prolonged distillation will be enriched by the hydrocarbons contained in the liquids brought into the apparatus from the hydraulic main. When steam is used in the manner stated above, it will be decomposed, and the resultant gases will be hydrogen and carbonic oxide, which will be enriched by passing through the above-named liquids, and increase the quantity of illuminating gas. Besides, the formation of injurious incrustations of carbon on the interior surface of the retorts will be prevented."

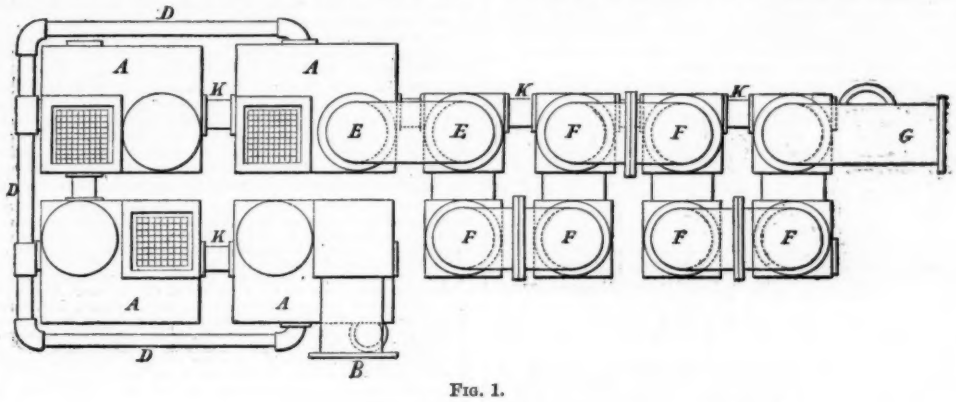


Fig. 1.

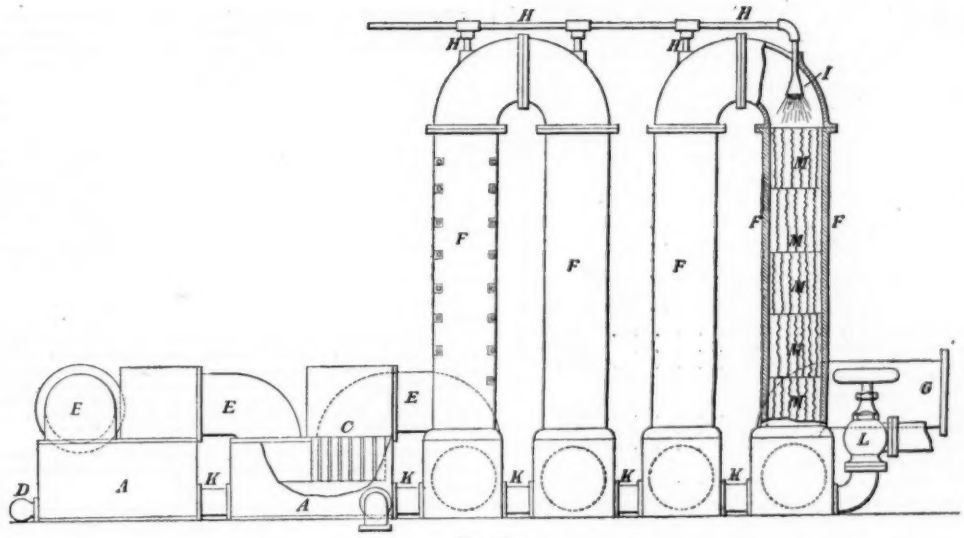


Fig. 2.

The accompanying engravings represent (fig. 1) a front elevation of apparatus constructed according to this invention; and (fig. 2) a plan of the same. In these, A, A represent a series of boxes constructed with gas-tight compartments at the top. There are three such series, although one only is shown; but it is not essential that each series should consist of four boxes, although this number may be used. The inlet-pipe, B, is secured to the top compartment of the first box of the series. The bottom plates of these top compartments are supplied with the dip-tubes, C, which form the only passages left for the gas, and are always submerged in the liquid to any depth that may be required. The liquid is brought forward in the pipe, D, where it enters the first of the boxes, A. The gas is forced through the seals or liquid lutes by the exhauster. After passing this point or seal, the gas rises up through the wire gauze and liquid, and is then conducted to the next box of the series by the pipe, E, and so on throughout the whole of the series. It afterwards enters the first section of vertical pipes, F; and rises and descends alternately until it passes out at the outlet-pipe, G, to the purifiers. At the top of the vertical pipes is a pipe, H, to convey the ammoniacal liquor of the hydraulic main into the vertical pipes at the top, where it is introduced in the form of a spray through the perforated disc, I. M, M are corrugated plates contained in the pipes, F. The liquid products that are brought forward from the hydraulic main are conducted through the parts of the apparatus in which this liquor is employed, by the pipe, K, as shown. The liquor makes its escape at the rear end through an adjustable valve, L, which controls the seals on the dip-tubes to any given depth. There is a similar valve to regulate the dip in the first and second series of boxes, A.

The arrangement may be varied by passing the gas through the boxes charged with liquor from the hydraulic main before it is passed through the boxes containing the alkaline solution.

Weights and Measures Act, 1878.—The Board of Trade Report to Parliament on their proceedings under this Act has just been issued. In it they state that, it having been represented that there is required for use in trade (particularly in the sale of coke) a measure of four bushels, they have given directions for the preparation of such a standard measure, and they propose to submit this new denomination of measure, when completed, for the approval of Her Majesty in Council. Also that a doubt has been raised as to the meaning of the Act with regard to the legal shape of the bushel measure; but, as affecting the use of the standard bushel, the Board are advised that the use of the existing shape of bushel is not interfered with by the Act. As to the gauges used in the measurement of metal plates, &c., the report states: "In the two last reports some information was given as to the practice in this country and abroad with respect to the different kinds of gauges used in various trades in measuring the thickness of plates or sheets of metal. The question was also adverted to of establishing in this country a standard gauge for use in all trades, or one by which the various gauges of manufacturers might be verified. The question is one to which the Board of Trade are prepared to give a favourable consideration as soon as they are further informed on the subject."

ON THE HEATING POWER OF COAL GAS OF DIFFERENT QUALITIES.

By Dr. WILLIAM WALLACE, F.R.S., Gas Examiner for the City of Glasgow.

[A Paper read before the Philosophical Society of Glasgow, on Wednesday, Dec. 3.]

The very extensive employment of coal gas for heating purposes, and especially for cooking, gives an interest to the question of whether the heating power varies like the illuminating power, and, if so, to what extent, in the gas used in different towns. As regards illuminating power, we know that it varies exceedingly. In Aberdeen and Edinburgh it is 30 candles for about 5 cubic feet per hour; in Glasgow, Paisley, and Greenock, about 26 or 27; in Liverpool, Manchester, and Carlisle, about 20; in London and Dublin, 16; in Birmingham and many other English towns, 14; and in some as low as 12 candles. But as regards heating power, we have no definite information, although there is a general belief that a rich gas has a greater calorific effect than one of poorer quality.

My attention having been directed to the subject by a correspondent, I caused a small apparatus to be made, in order, when opportunity offered, to test the matter practically. It is of very simple construction, consisting of a cylindrical tin-plate vessel, 8 inches in diameter and 6 inches high, with a cylindrical opening in the centre 1½ inches in diameter, through which the whole of the products of combustion pass. Below is a brass tube bent into a circle 5 inches in diameter, and pierced in 34 small holes, from which the gas burns with flames about ¾-inch high. This tube is placed 1 inch from the bottom of the vessel, and is surrounded by an outer case having a sufficient number of small holes for the admission of air. On the top of the vessel there are two openings, in one of which a delicate thermometer is placed, while the other is provided with an open glass tube.

The opportunity of using the apparatus occurred recently, when I had occasion to test on the same day three samples of coal which gave gas of 33, 26, and 15 candle power respectively. Each experiment occupied as nearly as possible 30 minutes, and consisted in raising one gallon of water from 60° to 160° Fahr., and measuring the gas consumed in the operation. The system is by no means a perfect one, but the results are strictly comparative. These are arranged in the following table :—

Illuminating Power of Gas, in Standard Candles.	Durability of 1 Cub. Ft. by Flame 5 Inches high.	Specific Gravity. Air = 1000.	Comparative Value for Lighting.	Gas Consumed in Heating Experiment.	Heat Units, Fahr., for 1 Cubic Foot.	Comparative Value for Heating.
	Min. Sec.		*s. d.*	Cubic Feet.		*s. d.*
33·07	64 45	574	4 10	1·916	522	4 5
26·24	54 40	525	3 10	2·200	455	3 10
14·75	39 35	442	2 2	2·888	347	2 11½

The heat unit represents the number of pounds of water heated 1° Fahr. by the combustion of 1 cubic foot of gas. I have taken Glasgow gas of 26 candles at 3s. 10d. per 1000 cubic feet as the standard of value, and it will be seen at a glance that while the heating value rises and falls with the lighting value, the amount of difference is by no means so great in the latter as in the former.

Having made these simple but instructive experiments, I naturally wished to compare the results with the theoretical heating values obtained by calculation from the composition of the gases. Unfortunately, I had no apparatus at the gas-works where the experiments were made for analyzing the gases; and the best I have been able to do is to make the calculations from two analyses by the late Dr. Letheby, one of 12-candle gas, and the other of London cannel gas, the illuminating power of which is not stated, but which may be assumed to be somewhere between 22 and 23 candles. The analyses are given only (as is usual with gaseous mixtures) by volume, but, for convenience, I calculated the composition by weight—

	Common Gas. Twelve Candles.		Cannel Gas. Twenty-two Candles.	
	Volume.	Weight.	Volume.	Weight.
Olefiant gas, &c. (C_2H_4)	3·8	9·5	13·0	24·9
Marsh gas (CH_4)	39·5	56·5	50·0	54·8
Hydrogen	46·0	8·2	27·7	3·8
Carbonic oxide	7·5	18·7	6·8	13·0
Carbonic acid	0·6	2·4	0·1	0·3
Nitrogen	0·6	1·5	0·4	0·8
Aqueous vapour	2·0	3·2	2·0	2·4
	100·0	100·0	100·0	100·0
Specific gravity (calculated)	387		506	
Weight of a cubic foot in pounds	·0296		·0387	
Calorific power (Cent.)	11,790		11,754	
Calorific power (Fahr.) pounds of waterh eated 1° by the combustion of 1 pound of the gas	21,222		21,157	
Heat units for 1 cubic foot (Cent.)	345		455	
Heat units for 1 cubic foot (Fahr.)	621		819	
Pounds of boiling water evaporated by 1000 cubic feet of gas	639		842	

We see from this tabular statement that, while the heating power of the two gases is almost identical, weight for weight, the practical result, when we take the same measure of gas, is very different, the cannel gas being much heavier than the common gas. I calculate that in my practical comparative test I have realized about 55 per cent. of the theoretical heating power, which is pretty nearly the proportion of effective heat by the combustion of coal in a well-constructed steam boiler.

The question naturally suggests itself, What is the comparative cost of heating by gas and coal? The calculation is a simple one. The theoretical heating power of ordinary soft coal may be taken at 13—that is to say, the number of pounds of boiling water evaporated by 1 pound, equal to 29,120 lbs. for a ton of coal, value, say, 11s. 6d., being the price of 3000 cubic feet of cannel gas, the heating power of which is, say, 2500. The gas, therefore, costs 11½ times as much as the equivalent quantity of coal, or, in round numbers, a pennyworth of coal gives as much heat as a shilling's worth of gas. When, however, we consider the handiness, the cleanliness, and the convenience of gas, it is not surprising that it is extensively employed as a source of heat, as an illustration of which I may state that in my own laboratory from 250,000 to 300,000 cubic feet are consumed annually, almost the whole of which is burned for the production of heat.

An interesting discussion followed, the speakers being Messrs. John Jex Long, W. P. Buchan, William Foulis, D. M. Nelson, and William Key. The last-named thought that Dr. Wallace had not obtained the full practical value out of the gas, seeing that he had not burned it on the Bunsen principle, to which Dr. Wallace replied that it was a mistake to suppose that the adoption of that principle was a necessity under all circumstances. In his case there would have been no advantage in adopting it, as he used small blue flames, which were totally devoid of smoke, and which therefore gave the most perfect combustion.

THE WASTE OF ENERGY IN THE PRODUCTION OF WATER GAS.

By Mr. EUGENE VANDERPOOL, Engineer of the Newark (N.J.), U.S.A., Gaslight Company.

[A Paper read before the Society of Gas Lighting, Oct. 9, 1879.]

Other things being equal, it is a question of time and experience for any process for the manufacture of gas that is more wasteful or economical in utilizing the potential or theoretical energy of coal than another, to be adopted or cast aside. Capital may for a time carry on with apparent prosperity undertakings that are founded upon unscientific bases, but it is a question of time only when these undertakings fail.

The decomposition of water by means of incandescent carbon was accomplished in the year 1793 by Lavoisier, and since then much time, energy, money, and intelligence have been devoted to the problem of making water gas economically, as compared with gas made from bituminous coal. This problem has not yet been so solved that the solution has been accepted by those qualified to judge of its success, and it is difficult to see how it can be where the supply of bituminous coal is abundant, and where there is a fair demand for the residuals of the coal gas manufacture. Broadly it may be stated that water is but the ashes of combustion, and the problem is to embue with energy a material that must obtain whatever energy it possesses in a gaseous form from other sources. In obtaining this energy, it is evident there must be a loss, and this loss has hitherto prevented the numerous experiments for producing gas from water, where carried out on a large scale, from being other than commercial failures. In the manufacture of water gas, that process is the most economical and successful, all things considered, that produces the largest quantity of gas from the smallest weight of coal. All of the retort processes, when the distillation or decomposition has been produced in the ordinary coal-gas retort, have been wasteful of coal, and have, from the thin beds of incandescent coal used, produced an excess of carbonic acid—a gas that the economical maker of water gas desires to have as little of as possible. Water gas is most economically produced where equal quantities of hydrogen and carbonic oxide are obtained from the combination between the water and carbon. The process of Messrs. John and Thomas Nesham Kirkham, patented in 1852, is so far the best for the economical production of water gas. In minor details it has of late years been improved on; but, substantially, gas can be made as cheaply by the Kirkham process as by any now in use. It is worthy of remark that the Kirkham process can be used by any one desirous of making water gas without expense for the use of patent, royalty, &c. The following is a description of part of the Kirkham claim :—

Improvements in the manufacture of gas for lighting and heating—consisting, first, in the mode of obtaining gas by decomposition of water in close furnaces. The furnace and ashpit in this case can be closed and rendered air-tight. Over the furnace, and heated by it, is a tubular boiler, containing water for the generation of steam. A regulated supply of hot air is forced into the furnace through the ash-pit, and the temperature of the furnace raised to the melting point of iron. A regulated quantity of steam is then also introduced near the bottom of the furnace. The resulting gases arising from this mode of internal combustion are caused to pass, first, through the tubes of the boiler, where they part with some heat to the water, then through tubes in an iron chamber, where they part with more heat to the air in the chamber. The air in this chamber is being forced through by a blowing machine, and is on its way to the furnace, and is thereby heated before it enters the furnace. The mixed gases are then passed to the condenser, purifiers, and gasholder, and may be employed in this state for the purpose of heating; or, if carburetted by naphtha or other liquid hydrocarbons, may be used for lighting purposes.

The name of the patentees of the above process is commonly known as Kirkham, although in the English edition of patents for inventions, printed by order of the Commissioners of Patents, it is Kirkman. It was the gas made by this process that was condemned and abandoned in France on account of its containing from 30 to 40 per cent. of the extremely poisonous carbonic oxide gas, the production of which dangerous gas, in large quantities, is inevitable in making water gas economically. It will be noticed that the gas obtained by the Kirkham process, if the manufacture was carried out precisely as stated in the specification, would contain a larger percentage of nitrogen than usually is found in water gas. But this method of working the apparatus is not at all necessary; and, indeed, the gas practically produced by this process, judging from the analyses made by Regnault, was ordinary water gas. But, if any of us desire to manufacture water gas, there are many processes to choose from. There is the process of M. Gillard, in use and abandoned twenty years ago, described in "A Treatise on Gas-Works," by Samuel Hughes, C.E., as follows:—

With the view of obtaining hydrogen more economically, M. Gillard erected a cupola similar to those in iron foundries. This was filled with coke or charcoal, ignited, and the fuel brought to a state of incandescence by a fan or blower; after which (all passage to or from the atmosphere being closed) steam was admitted at the lower part, and, passing through the volume of fuel, was decomposed, when the hydrogen and carbonic acid with which it was impregnated were withdrawn by an exhauster from the upper part of the cupola. From time to time the supply of steam ceased, and air was furnished by the blower as before, to bring the fuel to the proper degree of temperature for the decomposition. This plan, though much more economical than the retort system, did not succeed; the expense of manufacture was still very excessive.

It is not necessary to call your attention to any more of these old processes. It is well, sometimes, however, to remember that there is little that is new under the sun.

The Quantity of Carbon and Water Required to Produce 1000 *Cubic Feet of Water Gas, Theoretically.*

To produce 1000 cubic feet of water gas—no account being now taken of the fuel required to make the steam and heat the retorts—consisting of 500 cubic feet of hydrogen, and 500 cubic feet of carbonic oxide, there is required, theoretically, 24 pounds of water, which becomes decomposed into 500 cubic feet of hydrogen, weighing 2·66 pounds, and 250 cubic feet of oxygen, weighing 21·34 pounds; and 16 pounds of carbon, producing 500 cubic feet of carbon vapour, that combines with the 250 cubic feet of oxygen, and produces 500 cubic feet of carbonic oxide. We have 24 pounds of water and 16 pounds carbon, 40 pounds in all, producing 1000 cubic feet of gas, 500 cubic feet of which is hydrogen, and 500 cubic feet of which is carbonic oxide. The gas weighs 40 pounds, making a specific gravity of 0·531. The quantity of coal required to furnish the heat to produce this gas would be as follows:—In making the following calculation certain data have to be taken, and for the water gas we require the potential energy of anthracite coal, which is about as follows :—Anthracite coal of good quality has the composition—

Carbon	90·45
Oxygen and nitrogen	2·45
Hydrogen	2·43
Ash	4·67
	100·00
Specific gravity	1·46

The potential energy of which is about 13,000 heat units, but the energy utilized in practice cannot be taken at over 6000 heat units.

To convert the 24 pounds of water, at a temperature of 60° Fahr., into steam of 100 pounds pressure, would require 24 × 1153·4 = 27,681·6 heat

units, to generate which would require $\frac{27,681 \cdot 6}{13,000} = 2 \cdot 13$ pounds of anthracite coal. To heat the carbon, and keep it at a temperature sufficiently elevated to produce the dissociation of the water, would require—

For the hydrogen, 2·66 × 62,500 = ...		166,250 heat units.
Less combination between C and O = 16 × 4450 =	71,200	
Less heat furnished by steam	27,681	
	98,881	„
Balance		67,369 heat units,

and $\frac{67,369}{13,000} = 5 \cdot 18$ pounds anthracite coal.

The temperature at which the dissociation of water takes place being 2192° Fahr., according to St. Claire Deville, the gas leaving the generator at this temperature, unless there be some method of utilizing the heat, carries off in heat, the temperature of the gas at holder being 60° Fahr., as follows:—

Hydrogen, 2·66 (specific heat, 3·4046) × 2132 =		19,307 heat units.
Carb. oxide, 37·34 (specific heat, 0·2479) × 2132 =		19,734 „
Total		39,041 heat units.

which would require $\frac{39,041}{13,000} = 3 \cdot 00$ pounds of anthracite coal.

Therefore we have for the production of 1000 cubic feet of water gas, consisting of equal volumes of hydrogen and carbonic oxide—

Pounds of Anthracite Coal Required by Theory.

Pure carbon for dissociation of water, 16 lbs	18·00 lbs.
Anthracite coal to evaporate water	2·13 „
„ „ heat carbon	5·18 „
„ „ „ escaping gases	3·00 „
Total	28·31 lbs.

Or, theoretically, 28·31 lbs. of anthracite coal should produce 1000 cubic feet of water gas.

Practice Compared with Theory in the Manufacture of Water Gas.

But, as the practical efficiency of the very best steam-engines of large size, with the closest attention, is not more than 10 per cent. of the theoretical energy of their fuel, so, in the manufacture of water gas, there is a great deal more energy required than is indicated by theory. In the first place, a gas composed equally of hydrogen and carbonic oxide is never obtained; there is a great loss by intermittent action in working the apparatus, from radiation; and other sources.

In the manufacture of water gas by the Kirkham process, or that most largely used in this country, a greater quantity of water has to be used than is indicated by theory.

A large quantity of steam passes the generator undecomposed, so that in some methods no less than 100 lbs. of water have had to be evaporated per 1000 cubic feet of gas made. 50 lbs. is a low estimate. To convert this water, at a temperature of 60° Fahr., into steam of 100 lbs. pressure, requires practically $\frac{50 \times 1153 \cdot 4}{6000} = 9 \cdot 61$ lbs. of anthracite coal. There is required of carbon in the generator, in the shape of anthracite coal, for the decomposition of the steam, 20 lbs. per 1000 cubic feet.

To heat the carbon, and keep it at a temperature sufficiently elevated to produce the dissociation of the water requires—

For the hydrogen 2·66 × 62,500 = ...		166,250 heat units.
Less for combination of C and O, 16 × 4450 =	71,200	
Heat furnished by steam, 50 × 1153·4 . . =	57,670	
	128,870	„
Balance		37,380 heat units.

Required in anthracite coal,

$$\frac{37,380}{6000} = \text{. . } 6 \cdot 23 \text{ lbs.}$$

Loss by gas leaving generator, 39,041 heat units as above.

Required in anthracite coal,

$$\frac{39,041}{6000} = \text{. . } 6 \cdot 50 \text{ lbs.}$$

Loss by excess of steam not decomposed—

26 × (2132 — 1153·4) + (specific heat of steam ·475) = 11,084·8 heat units.

Required in anthracite coal,

$$\frac{11,084 \cdot 8}{6000} = \text{. . } 1 \cdot 85 \text{ lbs.}$$

Recapitulation of Anthracite Coal practically required to produce 1000 Cubic Feet of Water Gas.

Steam	9·61 lbs.	of anthracite coal.
Carbon	20·00 „	„
Heat in gasogene . . .	6·23 „	„
Loss by gas	6·50 „	„
Loss by steam	1·85 „	„
Total	44·19 lbs.	of anthracite coal.

So that with an apparatus properly erected and manipulated, and constant in its action, which none of the cupola processes are, it would be possible to produce 1000 cubic feet of water gas with an expenditure of 44·19 lbs. of anthracite coal. But in the cupola process the production is necessarily inconstant. In blowing vast quantities of air for alternate 15 minutes through a mass of coal varying in its heat from 1000° Fahr., or less, up to 2000° Fahr., there must of necessity be a great waste of fuel in getting this mass up to, and above 2500° Fahr. Then, again, when the steam is let on, the cooling must also be irregular, so that at the time of ending the steam blast the quantity of undecomposed steam, and, consequently, wasted energy, both of the steam boilers and the generator, must be large; and, indeed, experience shows that with care and expensive plant, from 75 to 100 lbs. of anthracite coal are required to produce 1000 cubic feet of water gas by the cupola process.

Again, a gas composed of equal parts of hydrogen and carbonic oxide is never obtained, there being present a percentage of CO_2 and N, which represents another waste of energy. A gas is obtained from the gasogene, on the average, of about the following composition:—

Hydrogen	55
Carbonic oxide	35
Carbonic acid	5
Nitrogen and sundries	5
	100

Composition of the water gas obtained in ordinary work by the cupola process.

An analysis of the water gas of the Municipal Gaslight Company, made by Professor Henry Würtz, Ph.D., March 4, 1878, is as follows (specific gravity of gas, ·4912):—

Composition of the Water Gas of the Municipal Gaslight Company.

Hydrogen	49·32
Marsh gas	7·65
Carbonic oxide	37·97
Carbonic acid	0·14
Nitrogen	4·79
Oxygen	0·13
	100·00

This gas contains an unusually small quantity of CO_2, and may have been taken after purification by lime.

An analysis of the Commercial gas is as follows:—

Analysis of the Commercial Gas of the Municipal Gaslight Company.

Hydrogen.	38·20
Marsh gas	15·82
Carbonic oxide	27·14
Carbonic acid	0·10
Oxygen	0·10
Nitrogen	3·35
Olefines	9·29
Paraffins	6·00
	100·00

Specific gravity of gas, ·6844.

The report containing these analyses may be found in the JOURNAL OF GAS LIGHTING, May 7, 1878 (Vol. XXXI., p. 722).

(To be continued.)

LEICESTER CORPORATION NEW GAS-WORKS.

The opening ceremony in connection with the new gas-works of the Leicester Corporation took place last Wednesday—Mr. T. H. DOWNING, the Chairman of the Gas Committee, turning on the gas.

The chief entrance to the works is from the Aylestone Road, and opens on the main avenue, which will eventually extend to the canal, a distance of 430 yards. The width is 40 feet, and the roadway will be paved in a substantial manner, sufficient to withstand the heavy traffic that will pass over it when the works are in full operation. On the left are the superintendent's office, with the general office and private offices; and on the right the timekeeper's office, governor-house, and testing-room; and immediately inside the entrance gates is a weighing machine. The greatest portion of the main block, or first section, is occupied by the retort-house, on the right of the avenue, and this is the only one which has been constructed at present. Ultimately there will be three other retort-houses, each succeeding one, from the Aylestone Road to the canal, being larger than its predecessor. All of them will be on the same side of the avenue. The first is 280 feet long and 80 feet broad, with a coke and coal shed on each side, each measuring 50 feet across; thus making the breadth of the block 180 feet. The last retort-house to be erected is intended to be 470 feet in length, although of the same breadth. The whole four, when the retorts in each are used simultaneously, will, it is calculated, be capable of producing 12 million cubic feet of gas in 24 hours, which is four times the quantity now supplied. Between each will be a coke yard 80 feet wide, and a boiler-house intervening, each pair containing three boilers 20 feet long and 7 feet in diameter. A workmen's room is fitted up for the use of those employed, supplied with arrangements for cooking, and furnished with lavatories. The floor of the retort-house is 20 feet below the level of the Burton Branch of the Midland Railway, so that to convey coal to the works, sidings had to be erected corresponding in height to the embankment of the line. The sidings in all measure 700 or 800 feet, but the Midland Company, it is said, have agreed to bear a portion of the expense. The trucks which will be used are constructed specially with drop bottoms, so that the coal falls through the bottom, and descends through shoots just in front of the retorts, where it is required. The coal store is on the upper level, the heavy weight resting on iron floors, supported by a number of iron columns. All the shunting for the siding is done by a small locomotive. Where the sidings enter the building, weighing machines are stationed. At the present time only one-half of the retort-house is in use. There are 91 through retorts 20 feet long, capable of producing 1 million cubic feet of gas per day. The remaining half of the house will probably be occupied next summer, and it can be fitted up at a comparatively small outlay. On the low level, past the retort-house, and extending across the works, is a set of metals, on which the trucks are laden with coke. They are then taken to the extremity nearest the railway, and raised to the level of the embankment by a hydraulic hoist. On the left of the avenue, next to the offices, comes the storehouse, 50 feet long by 30 feet wide, divided into upper and lower stories. Next in order is the station-meter house, which measures 75 feet by 30 feet, and is intended for four station-meters. Only one, however, is at present constructed, and is able to pass 60,000 feet of gas per hour. The foundations have been laid for a second, but one-half of the house is now temporarily used as a blacksmith's shop. Two out of six condensers only have been completed, each being 45 feet long, and between these, in the ground, are two large tanks, 90 feet long and 11 feet and 12 feet deep, for the tar and ammoniacal liquor. The dimensions of the exhauster-house are 50 feet by 30 feet, and in it are two exhausters capable of passing 100,000 cubic feet of gas per hour. Room is left for a third—indeed, the foundations have been put in. There is also in the same place a small engine for working the hydraulic hoist. The next building is the engine-house, 20 feet by 22 feet. In this there are two engines, and it is intended that they shall do the pumping, work the mortar mill, the scrubbers, and the lathe in a mechanics shop, which, however, has yet to be built. At the back of the block is a range of pumps for the purpose of pumping water, tar, and ammoniacal liquor. Six of Mann and Walker's scrubbers are to be provided, but only two at present are at work. Each one is 75 feet high and 12 feet in diameter. In the rear of the exhauster and engine house are the purifiers, of which there are at present five, each measuring 24 feet square; but eventually three more rows of five each will be added, and thereby increase the number of purifiers to twenty. Space has been reserved for the erection of seven gasholders, distributed so as to utilize any spare land. One is already erected, and the capacities of the others will be similar to it in all respects. Each will contain about 1¼ million feet of gas. The tank for a second has been completed, of 172 feet 6 inches in diameter, and 35 feet deep; while the holder which has already been constructed is 170 feet in diameter, and, being telescopic, will rise to a height of 70 feet, supported by 18 columns. A row of 23 workmen's houses are in course of erection, fronting the Aylestone Road. Near the offices, immediately inside the main entrance, is a tall tower, in which will be

placed a clock with four dials, and bells on which the quarters and the hours will be struck. Messrs. G. A. and C. S. Robinson, who have so successfully managed the old works, are the Engineers for the new works. The estimated cost of the part of the works now nearly completed is £115,000, of which £100,000 has been expended. The whole area of ground on which the works stand had originally to be raised to a height of 7 feet above its natural level, so as to prevent any liability to flooding. To effect this, the material which was obtained from the necessary excavations was used.

Mr. DOWNING, after turning on the gas to the town main, congratulated the Council on the opening of the works, the building of which had, he said, been attended with a large amount of anxiety—not altogether borne by him alone, for he could not comprehend all the dangers and the difficulties, but still he had shared, to some extent, that of his friends, Messrs. Robinson, who had been indefatigable in their attention to the work. He was sure they must be that day proud at the completion of so long and anxious a task. To him it appeared that a vast quantity of work had been done, and, compared with anything else they had experienced in Leicester, they would see that a large amount of anxiety and concern had been felt by Messrs. Robinson for the works. In spite of a few accidents and delays which had occurred, it was a matter of congratulation that they were able to open the works thus early; though none too early, considering that the weather had become so severe.

After an inspection of the works, luncheon was served in the Corporation Gas Office—Mr. DOWNING again presiding, and being supported by the MAYOR (Mr. J. Bennett).

After the usual loyal toasts, and "The Mayor, Magistrates, and Corporation of Leicester," had been drunk,

The CHAIRMAN read letters of apology for non-attendance, received from Mr. W. E. Hutchinson, the former Chairman of the Gas Company, and from others. In afterwards proposing "Success to the Gas Undertaking," he referred to the conflict of opinion as to the suitability of the site, and the negotiations which led to the purchase of the works. They had been, he said, in possession of the works for 18 months, and he need only refer to the half year's balance-sheets to show that the expectations of the promoters, sanguine as they were, had been fully realized; and, although they had spent £115,000 on the new works, they felt confident, all things considered, they would be fully remunerative. Upon looking back upon the transfer, they must all feel gratified that it took place without any of those unpleasantnesses which sometimes attended the transfer of large undertakings. At the expiration of twelve months they found, after paying all liabilities, and placing aside £5000 as a reserve-fund, and £2000 as a sinking-fund, that there remained a surplus of £8000, which had gone towards the general district-rate, and this would do much to keep down the rates, if not to lower them. They must bear in mind that there would be increased charges upon invested capital, and they could not expect to maintain the same rate of clear profit in favour of the district-rate that they had done during the past twelve months; but they were all satisfied that they would make the undertaking satisfactory to them as a Corporation and to the town generally. Leicester was first lighted with gas in 1821 or 1822, and in 1829 the price of gas was, not 2s. 8d., but 12s. per 1000 feet; in 1834, 10s. 6d.; in 1839, 7s. 6d.; in 1847, 5s. 10d.; in 1850, 4s. 8d.; in 1860, 4s. 2d.; in 1865, 3s. 6d.; in 1870, 3s.; in 1877, 2s. 10d.; and in 1879, 2s. 8d. It was a matter of congratulation to the Committee that they could boast of gas at 2s. 8d. per 1000 feet, and that Leicester ranked among the first of the large towns in the kingdom supplying at so low a price.

The toast was received with much applause.

Mr. G. A. ROBINSON responded, and said no one was more pleased than himself that the new works were in such a forward state. He had hoped they would have been completed four or five weeks ago, but several trifling accidents had occurred. He was very much indebted to the Architects, (Messrs. Shenton and Baker), to the Clerk of the Works (Mr. Gilbert), and to Messrs. Smith and Gibbon, for the assistance they had rendered.

Mr. C. S. ROBINSON also replied. He stated that although they had had some accidents, none had proved fatal. It had been said that the works, when completed, would be A 1; but, however that might be, he must say that he and his brother had received great assistance from the Chairman of the Committee and the other members. He and his brother were not only proud of the works because they believed that they could turn out gas there as cheap as anywhere else, but because they thought the buildings were handsome, and thanks were due for this to Messrs. Shenton and Baker, who were responsible for the ornamentation. The work of himself and his brother was chiefly buried under the ground, and what was seen was not very good looking.

Mr. HOLYLAND (Vice-Chairman of the Gas Committee) proposed "The healths of the Architects, Messrs. Shenton and Baker," and, in doing so, said better designed gas-works could not be found in the Midland Counties, and they did the Architects great credit.

Mr. SHENTON acknowledged the compliment; and other toasts—among others "The Chairman"—having been proposed, the proceedings ended.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

In the coal trade of this district prices generally are firm so far as round coal is concerned, and an advance of about 6d. per ton is, in most cases, being obtained upon October rates. Prices, however, are, as a rule, below those ruling last winter, and any further advance upon that above mentioned is very difficult to realize, as there is no scarcity of supplies in the market; and although some of the collieries are fully supplied with orders, there are many of them that are not yet working more than eight to nine days a fortnight. There is no doubt that trade is better, but the market is still in that condition that colliery proprietors have to exercise very great caution in advancing their prices, and any upward movement in values must at present be very gradual. So far as the better classes of round coal are concerned, the colder weather is naturally causing an increased demand for house-fire purposes, and as works generally, especially those connected with the iron trade, are busier, the lower classes of round coal for steam and forge purposes are also selling more readily. Burgy and slack are, however, bad to move, with prices quite as low as ever. The average quotations at the pit mouth are about as under:—Best Wigan Arley, 9s. to 9s. 6d.; inferior sorts, 7s. to 7s. 6d.; Pemberton four-feet, 6s. 6d. to 7s.; common round coal, 5s. 6d. to 6s.; burgy, 3s. 9d. to 4s. 3d.; good slack, 2s. 9d. to 3s. 3d.; and common, 2s. to 2s. 6d. per ton.

In the shipping trade there has been a fair inquiry, but vessels have been difficult to obtain, in consequence of the contrary winds, and the amount of actual business doing has not been large.

In the coke trade there is a steadily improving demand, and prices generally are firmer.

With regard to the wages agitation, no definite action has yet been taken by either the masters or the men, but from what I can hear there is little disposition on the part of colliery proprietors to entertain any advance in wages until there is some more substantial improvement in trade.

In the iron trade there is a very firm tone, and as makers, both of raw and finished iron, are now in most cases fully sold for the next three or four months, those who have iron to offer are asking prices which, in some cases, are almost prohibitive, whilst for forward delivery makers are only quoting at a considerable advance upon present rates. Lancashire smelters are now quoting 56s. per ton, less 2½, for No. 3 foundry delivered into the Manchester district; but orders for forge iron have been refused at the above figure, as they have now very little of the better class of iron to sell. Bar and hoop makers are very busy, chiefly on orders for export, and as most of them have now work in hand for the next three months, new speculations are very difficult to place. For Lancashire bars delivered into the Manchester district the lowest price is now £7 10s. per ton; common hoops are quoted at £7 10s., and the best qualities at £8 5s. to £8 10s. per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The sudden appearance of intensely cold frosty weather has been somewhat of a hindrance to the shipment of gas coals, but not much. The snow which fell in the early part of last week did not lie so deep as to stop traffic in the colliery waggon-ways, but the frost bound small coals in the waggons into a sort of cake in transit, and the trimmers at the shipping-places have had the greatest difficulty in breaking them out of the waggons to slide into the vessels holds. This is an occurrence which has rarely, if ever, happened previously.

The tonnage to hand has been abundant, and the requirements of the gas-works in all parts of the United Kingdom have been met very fully. It is needless to say that at this time of the year all kinds of marketable gas coals are in full demand. The leading collieries have as much as they can stand to. The fitting offices in connection with these latter pits report that they are well contracted over the whole of next year. The price is somewhere between 6s. 6d. and 7s. per ton—higher class in several instances the latter figure—with 2½ per cent. discount. That is the quotation the collieries make for odd cargoes in the open market.

Several sailing vessels of between fifteen and twenty keels have been taken up this week to load gas coals for the Channel ports. The Irish gas-works are now very well supplied with shipping. Though the weather has been so severe, there has been no sudden "jump up" of coal freights. Indeed, if anything, they are a little lower. The rates paid steamers to load coals for London are 4s. 3d. and 4s. 6d. per ton. As all the gas coals are brought to the shipping-places by railway, and none by craft, the closing of the upper reaches of the Tyne with ice will in nowise interfere with shipments.

The general manufacturing trade of the North of England was not quite so lively last week as it was in November. Probably the sudden closing of the interior navigation of Europe might operate as one cause leading to it; but it was pretty apparent that the greatest difficulty was experienced in maintaining recent quotations. Chemical manufacturers failed to uphold their prices, and there was a visible recession of rates. The only exception was the lead market. In it the quotations were higher. But it is a question whether the price now asked for lead—about £18 a ton—can be maintained. There were two sales of Greek lead last week. The first lot brought £17 2s. 6d., and the rest £17 5s. This was 30s. rise upon a sale which took place a month ago. There was another sale of 600 tons of Greek lead on Friday. It brought £17 12s. 6d. per ton.

Whilst crude iron cheapened last week, the demand for manufactured iron was very strong. Manufacturers would not undertake more than a week's delivery for iron bars. The price of bars on the Tyne in September was £5 10s. per ton. Bars are now quoted at from £7 10s. to £8 per ton. The price of red lead is correspondingly high with the advance in the value of lead in bars.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

As the 15th of December draws nigh, evidence accumulates to show that there is every probability the forthcoming Exhibition of Gas Apparatus in Paisley will be a very great success. It is intended that the exhibition shall embrace all the recent improvements and novelties in gas heating and cooking stoves, gas fires, gas ironing apparatus, gas-engines, &c., all in active operation; as also the most perfect and approved systems of gas illumination, including burners, brackets, and shades of elegant design; and continuous practical demonstrations are to be given for the benefit of gas consumers. There are to be refreshments served, which visitors may see cooked under their own eyes. None but gas-cooked articles will be supplied. It would seem as if Mr. Hislop, the popular Manager of the Paisley Corporation Gas-Works, has practically all the work of the forthcoming exhibition on his own shoulders, in which case he has no small amount of care and responsibility to go through. It may be remembered that the Exhibition is to be open from the 15th till the 26th of December.

At last Thursday's meeting of the Town Council of Hamilton, the Gas Committee stated, in a minute, that an irregularity had been reported by the Manager as to Mr. Tainsh (a member of the Council, and formerly Convener of that Committee) having made a connection with one of the gas-mains without the knowledge, concurrence, or oversight of the Manager, and for which he declined to hold himself responsible. The Committee suggested that Mr. Tainsh be allowed an opportunity of explaining and admitting his error, failing which they wished to be instructed as to whether or not the penalty incurred should be exacted. Such an alleged irregularity naturally led to a discussion, in which a good deal of strong speaking and recrimination took place. It was stated that the penalty incurred was £5, and £2 a day afterwards. Mr. Tainsh practically admitted that he had made a connection with a branch pipe on which a lamp was placed, but he insisted that he had not touched a main, and he would not acknowledge that he had done any wrong, while in justification of what he had done, he affirmed that his reason for not applying to the Manager was, that when he asked him on a former occasion to put in a branch for him at another place, he took about two months to do it. Eventually the report was adopted, but without any instructions to the Gas Committee to institute legal proceedings against Mr. Tainsh.

The Forfar Gas Corporation held a meeting on Wednesday—Provost Lawson in the chair—when Mr. Whyte submitted his motion that the Gas Committee be instructed immediately to consider the question of supplying additional gas storeage accommodation at the works, with powers to take what professional advice they may consider necessary, and, if advised, to obtain an estimate of the expense, and report to an early meeting of the Corporation. He showed that the storeage accommodation is very inadequate, and that through a recent accident to the gasholder the town had run much risk. Extraordinary retort power had to be used. An additional holder would cost £2761, or £133 2s. 6d. per annum for 50 years, whilst a saving of £236 18s. per annum would be effected, or a net saving of £156 17s. 6d. He suggested that the Manager of the Aberdeen Gas-Works be consulted. In the course of his speech he read extracts from the JOURNAL to show that the storeage accommodation at gas-works should be at least equal to the gross make of gas per day of 24 hours (which was not by any means the case in Forfar), otherwise a heavy loss

was entailed. Mr. Reid seconded the motion, which was ultimately adopted unanimously.

An official report on the quality of the gas supplied to Greenock during the month of November states that 25 experiments with the photometer showed the minimum illuminating power was 26·77 candles, the maximum 33·79 candles, and the average 29·78 candles, the average temperature of the gas while testing being 58·92° Fahr.

A dividend of 5 per cent. has just been declared by the Inverkeithing Gaslight Company.

There have recently been two additional bursts in the water-main leading from Lintrathen to Dundee—one on Friday morning, and the other on the night of Saturday week, and both in the neighbourhood of Meigle. Within six months there have been three bursts in a length of some 50 or 60 yards, and there was one last year in the same place.

At a meeting of the Edinburgh and District Water Trust, held on Friday, it was resolved to apply to Parliament in the ensuing session for additional borrowing powers to the extent of £120,000.

A large amount of business was done during the past week in the Glasgow pig iron market. Up to 61s. 1½d. cash was paid on Monday, and the price fell to 58s. on Thursday, the close on Friday being 59s. cash.

The coal market continues to be irregular. Orders for all descriptions are scarce, and prices remain unchanged.

Sale of Shares in the Guildford and Sheffield Gas Companies.—On Saturday, the 29th ult., Messrs. Drewitt and Sons offered for sale 71 shares in the Guildford Gas Company. Ten £25 A shares, bearing a dividend of 10 per cent., realized the unprecedented sum of £517, the other shares yielding a corresponding and proportionate value.—On Tuesday last, Mr. W. Bush sold at Sheffield a £30 C share in the Sheffield United Gas Company for £61 5s.

Reduction in the Price of Gas at Richmond (Surrey).—The Richmond Gas Company give notice that on and after the 1st of January next the price of gas to consumers in the parish of Richmond will be at the rate of 3s. 9d. per 1000 feet, and for the outlying districts 4s. 3d. per 1000 feet, being a reduction in each case of 3d. per 1000 feet. The charge for the public lamps will also be reduced, from £4 15s. to £4 10s. each per annum.

Crawley Gas Company.—The annual general meeting of this Company was held last Friday, when the Directors reported that the result of the working during the year ending Sept. 30 was very satisfactory, and that the works were maintained in a full state of efficiency. The balance in hand available for dividend was £262 15s. 3d., out of which the Directors recommended the payment of 6 per cent., free of income-tax, leaving £94 15s. 3d. to carry forward.

Extension of the Water Undertaking of the Bath Corporation.—At the meeting of the Bath Town Council on Tuesday last—the Mayor in the chair—a report was presented from the Water Committee, advising the purchase of the Charlcombe Water-Works, and an application to the Local Government Board for a loan of £8000 for the purpose, to extend over a period of 60 years. Mr. Heywood moved, and Alderman Marshall seconded, the adoption of the report. An amendment that 30 years be substituted for 60 years was proposed, and carried by 16 votes to 3. On the recommendation of the same Committee, it was also resolved to apply for a loan of £400, extending over a period of 30 years, for the purchase of the St. Saviour's and Prior Park Water-Works.

The Corporation of Hull and the Electric Light.—A special meeting of the Hull Town Council was held last Thursday to consider the advisability of, and to sanction the Corporation applying to Parliament for an Act enabling them to obtain all necessary powers for lighting the borough and adjoining districts by means of electricity, or otherwise than by gas. A motion sanctioning the promotion of a Bill having been proposed, the following amendment was moved:—"That in the absence of any information as to the cost of street lighting by electricity, the Council deem it undesirable at present to make any application to Parliament for powers to light the borough by means of electricity, and that all resolutions to the contrary be rescinded." After a long discussion, the amendment was negatived, and on a division being taken on the original motion, it was declared carried by 36 votes to 12.

The Water Supply of Tewkesbury and the Sewage Pollution of the Severn.—A meeting of the Tewkesbury Local Board was held on Monday of last week, when the following resolution was agreed to, on the motion of Mr. W. G. Healing, seconded by Mr. Nind—"That the waterworks supplying the borough having been transferred to the Cheltenham Corporation twelve months ago, and no steps having been taken by them to free the River Severn from the pollutions of which evidence was given before the Committee of the House of Commons, the Board is of opinion that it is incumbent that immediate steps be taken by the Cheltenham Corporation to prevent the pollution from the sewage of Worcester and other places; and that a copy of this resolution be forwarded to the Cheltenham Corporation, with an inquiry as to what steps they have adopted, or intend adopting, to secure the object in view."

Wigan Corporation Water Supply.—At the meeting of the Wigan Town Council last week, to discuss the requirements of the town, in order that the necessary powers in reference to them may be applied for in the Improvement Bill of which notice has been given, it was agreed that the following instructions, in regard to the Water Section, should be given:—The Corporation have exhausted their borrowing powers under the Wigan Water-Works Act, 1853, and the Wigan Water-Works Act, 1860. Within the last two years the Corporation have paid about £5000 in laying down new mains, in the purchase of mines under the reservoir, and in the purchase of certain rights to impound water. These sums have been obtained without any direct parliamentary authority to raise money for those purposes, and it is now wished to obtain power to borrow a sum of £10,000 for water-works purposes. This would enable the Corporation to adjust the matter, and to carry out certain contemplated extensions of mains and works, which are rendered necessary by the growth of the town.

Local Government Board Inquiry at Haworth.—An inquiry was held at Haworth, on Saturday, the 29th ult., by Mr. C. N. Dalton, one of the Inspectors of the Local Government Board, respecting an application of the Haworth Local Board for a Provisional Order giving additional borrowing powers to the amount of £8000 for gas purposes, and allowing some modifications of the provisions that now rule the sinking-fund. New works for an increased supply of gas are contemplated by the Board, and these will cost upwards of £5957. The remainder of the £8000 will, it is believed, be expended in connection with the gas-works during the next few years. Mr. Dalton, remarking upon a deficiency of £2300 which had accumulated as a bank debt in connection with the works, said that the Board could not obtain power to borrow on mortgage in respect of such a deficiency, because it ought to have been from time to time made up out of the general district-rate. The deficiency need not have existed, but the Board had charged too low a price for their gas.

Opening of the Bridgwater Corporation Water-Works.—The Bridgwater Water-Works, provided by the Corporation at a cost of nearly £40,000, were formally opened last Tuesday. The Bridgwater (Corporation) Water Act obtained the Royal Assent in August, 1877, and it authorized the borrowing of a sum not exceeding £33,000, the estimate of the Engineer, Mr. T. Hawksley, being £32,000. The source of supply is the junction of what are known as the Seven Wells and Cockercombe streams, at the foot of the Quantock Hills, about six miles distant from the town. The sum of £33,000 has been borrowed by way of private loan at 5 per cent. interest, and the estimate has been so far exceeded that it will be necessary to borrow a further sum of nearly £7000, representing a total of £40,000. The opening ceremony commenced at three o'clock in the afternoon, when, on the invitation of the Mayor (Mr. W. T. Holland), the members of the Corporation and a large number of the inhabitants proceeded to the Cornhill, where a fountain was played and some speeches were delivered. This was followed by a public dinner.

Association of Municipal and Sanitary Engineers and Surveyors.—On Friday last, the members of this Association met together in the new sewage pumping station at Merton, which has been constructed in connection with the sewerage scheme now being carried out by Mr. Baldwin Latham, M.I.C.E., for the Croydon Rural Sanitary Authority. Among the papers read was one on the "Sewerage Works of the Croydon Rural Sanitary Authority," by Mr. W. Santo Crimp, Assoc. M.I.C.E., Resident Engineer of the works. In this paper the Author described the works generally, and entered into the details of the construction of the sewers, which are made as nearly as possible water-tight by means of a collar-joint of Portland cement and sand. Many of the Borough Engineers from the principal towns took part in the discussion which followed. The meeting, so far as the reading of papers was concerned, was concluded by a paper entitled "Notes on Ironwork," by Mr. Graham Smith, Assoc. M.I.C.E., Secretary of the Association. The object of this paper was to point out the various considerations and difficulties affecting the design and construction of wrought ironwork. Messrs. B. Cook and Co., the Contractors for the Croydon Sewerage Works, then invited the members to take refreshment, and an inspection of the works in course of construction terminated the proceedings.

The Water Supply of Milton and Sittingbourne.—At the meeting of the Sittingbourne Local Board last Tuesday, a letter was read from the Local Government Board, enclosing a copy of the correspondence which had passed between them and the Milton Commissioners, on the Water Question. They also sent a copy of the petition addressed by the Milton Rural Sanitary Authority to them, praying that a Provisional Order might be issued, uniting the districts of the Sittingbourne Local Board, the Milton Commissioners, and the Rural Sanitary Authority, for the purpose of providing a common water supply, by the Joint Board purchasing the Sittingbourne Water-Works, and suggested that there should be a conference between Major Tulloch (their Inspector) and the three Authorities. Some of the members of the Local Board strongly opposed other Authorities coming into partnership with them, seeing how profitable the waterworks were likely to become; but the Clerk pointed out that the proposal was an alliance, and not a partnership, and that the revenue from the consumption of water at Sittingbourne would not be shared by the other Authorities. Eventually it was decided to bring under the notice of the Local Government Board the answers the Board have already given to the Milton Commissioners and the Rural Sanitary Authority; but, at the same time, state that they had no objection to the proposed conference.

Darwen Corporation Gas Supply.—At the monthly meeting of the Darwen Town Council, on Monday last week, it was resolved—"That application be made to the Local Government Board in London for the sanction of power to borrow such sum as may be required on account of capital account in connection with the gas-works." The Mayor, in moving the adoption of the resolution, said he had intimated in the Gas Committee more than once that they were spending a large amount out of the revenue which it would no longer bear. Within the last three or four years they had spent out of the revenue £9413 10s. 2d. upon various works and in the purchase of property. They had spent or were spending £1334 on the extensions in connection with the gas and water works, and consequently instead of making profits out of their revenue, they were positively in debt. The sum that he proposed to ask for power to borrow was £7500. They would require about £1484 8s. 8½d. for a gasholder, and they had 1222 yards of mains to buy and to lay, 100 new lamps to provide, fireplugs, and other sundries in connection with gas and water, amounting to £7353 4s. 9d. He might also urge the reason that they were providing for the future generations, and that they had a right to spread the cost of the improvements over a number of years, instead of, as heretofore, taking it all out of the revenue. At the same meeting, the Mayor reported that an arrangement had been entered into with the Blackburn Corporation with regard to the seizing of meters at Lower Darwen, which we have previously referred to. The Blackburn Corporation were to pay them £275, and to write an apology for their tactics in the matter, and instead of having the old meters returned, the Darwen Corporation would have the new meters that had been put in their places. He thought it was only right now to state that the Chairman of the Gas Committee at Blackburn had written to the papers a letter, in which he took the whole responsibility of the transaction upon himself. He called attention to that, in order that no blame might rest upon the Town Clerk of Blackburn. The Mayor of that town had also expressed his great regret at what had been done. It was done unknown to him, and to nine-tenths of the members of the Blackburn Town Council. The subject then dropped.

The Liverpool Corporation (Vyrnwy) Water Scheme.—Last Wednesday, a deputation consisting of the Severn Commissioners, the Mayors of Gloucester and Worcester, and representatives of towns interested in the navigation of the Severn, had an interview, as to the above-named scheme, with the President of the Board of Trade, who was accompanied by Mr. Talbot, M.P., and Mr. Cecil Trevor. Sir E. Lechmere, M.P., in introducing the deputation, said it represented the trade and commerce of the Severn, which was likely to be very much injured by the proposed abstraction of water. The proposal was to construct a large reservoir, and to abstract 40 million gallons of water per day from the Vyrnwy. This would occasion a want at some seasons of the year, and the navigation of the river Severn would be very seriously affected. Mr. Marten, the Engineer to the Severn Commissioners, explained the engineering features of the scheme. He said the Liverpool Corporation proposed to take the water from 23,000 acres of land. The water coming from that area in times of flood went into the River Severn in a very turbid state. It consequently deposited large quantities of silt, and if a large body of water were abstracted, nothing would remain to scour away this silt, and the river must necessarily contract the whole distance down to its estuary. The Mayors of Worcester and Gloucester having spoken, Lord Sandon, in reply, said the Board of Trade had only to do with tidal waters, and, supposing that they believed any danger was likely to accrue to tidal waters, in the interests of the country—that was, supposing the Bill to be before a Committee of either House of Parliament—they would send to the Committee statements of their position on the subject, calling their attention to the

dangers which they apprehended might occur. Beyond that it was not the function of the Board of Trade to take any steps. It was a subject for the consideration of the Government, as a whole, whether or not they should take action in the matter. With regard to this, they would not expect him to give any opinion at that moment, nor as to the proposition of the Severn water-way being affected by the Liverpool water scheme. It would have to be proved to the Board of Trade that some damage was likely to be done to the tidal waters. He would take care that the whole subject was considered by the Government, but he wished to separate the two matters—the departmental action of the Board of Trade, and the attention which the Government was bound to give to this great matter. The deputation then withdrew.

Society of Engineers.—As briefly announced in last Tuesday's issue, at a meeting of this Society on the previous evening—Mr. R. P. Spice, President, in the chair—a paper was read by Mr. Henry Robinson, C.E., on "Sewage Disposal." The Author in the first place described the different systems which are employed for the removal of the refuse of the community, and the advantages and disadvantages of each. He then called attention to the large number of deaths recorded annually in the Registrar-General's returns, arising from preventible diseases, due to bad house sanitation and defective sewerage; and he referred in detail to the chief causes and to the remedies for these evils. He condemned the apathy shown by the Vestries in the Metropolis, and sanitary authorities generally, to the provisions of the several Sanitary Acts, and pointed out that the duties which had been imposed by the Legislature on these authorities were practically disregarded. The pollution of water by its storeage in uncleansed cisterns was referred to, and an opinion expressed that the water as supplied to the Metropolis was not the cause of illness, but its pollution after delivery; and that far more blame attached to the householders for not examining their cisterns than to the Water Companies. The Author advocated the expeditious completion of the constant service, which was now being gradually accomplished. The operation of the Rivers Pollution Prevention Act was then considered, and the necessity for its amendment shown, owing to the difficulty experienced in arriving at an agreement as to what was a reasonable system to enforce, in the varying circumstances of towns, in respect to the purification of sewage. The exemption of the River Thames and the Metropolitan sewage was referred to, and this question was considered at some length, the Author expressing an opinion that the sewage of the Metropolis should be purified before its discharge at the outfalls; and, from calculations he had made, he considered chemical treatment would be the cheapest, and could be accomplished for 7d. per head. He pointed out that the arbitration between the Conservators of the River Thames and the Metropolitan Board of Works was really dealing with the commercial part of the question—namely, as to interference with the navigation—leaving the sanitary part for future consideration, as apparently of secondary importance. The Author then at considerable length entered into the laws which govern the disposal of sewage upon land, and gave the average results of 22 towns he had investigated, which were as follows:—39·3 gallons of sewage per head of the population per day. The sewage of 114 people to an acre of sewage farm. Cost of sewage farm 1s. 10d. per head of the population, and 6¼d. in the pound of rateable value. Where land could not be obtained as a purifier and utilizer of sewage, he indicated methods of dealing with it by chemical treatment. In conclusion, he abstained from recommending any system, stating that his experience had led him to advise the adoption of a system for a town according to its own special circumstances, and considered that those who advised in these matters, whilst being free from bias in favour of any system, should be practically familiar with them all.—A long and interesting discussion followed the reading of Mr. Robinson's excellent paper, in which Mr. Baldwin Latham, Mr. H. P. Stephenson, Mr. Alfred Williams, Mr. J. Shiress Will, Mr. Perry F. Nursey, Mr. G. E. Eachus, Mr. Brooking, and other gentlemen took part. The President, in closing the discussion, observed that it had been truly said they were dealing with a vexed question. The highest authorities were divided. There was no doubt that the sewage of towns and cities must be carried away by water, because water was the cheapest carrier; but then the question arose where the engineer's duty was to end and the chemist's to begin. Were he an autocrat, he would not have the sewage poured into the Thames. It was, however, there; but he thought it should be taken to Maplin Sands, or at least so far down the river as to be less objectionable than it was at present.——At the meeting the following gentlemen were balloted for and duly elected:—As Members, Mr. Alfred Penny and Mr. Thomas Rowland Jordan; as Associates, Mr. Charles Clauson and Mr. John Henry Buchan.

Register of Patents.

1869.—Arundel, G., Sheffield, "*Improvements in water-taps.*" Patent dated May 9, 1878.

This invention applies more particularly to screw taps, and consists in the use of a removable valve-seat of leather, rubber, or other similar material or suitable metal, and in the arrangement of the parts to accomplish this purpose. In the construction of a high-pressure tap (for example), the ordinary arrangement of a screw pressing down or releasing a leather-faced valve is used, but instead of the seating being formed in one with the metal of which the tap is constructed—that is to say, being part of the tap itself—as is usually the case, the tap is made with a loose and removable seat, so that at any time it may be removed if desirable. This seat may be constructed of leather, horn, rubber, vulcanite, or similar material, or of any suitable metal, and is held in position by a support or disc of metal screwed up through a suitable opening in the under side of the tap, which is then closed by a screw plug; or the plug may be elongated sufficiently to answer both of these purposes, having a suitable water-way through it.

1860.—Abel, C. D., Southampton Buildings, London, "*Improvements in the hydraulic mains, stand-pipes, and other conduits or receptacles for gas, employed in the manufacture thereof.*" A communication. Provisional protection only obtained. Dated May 9, 1878.

This invention has for its object to prevent the formation of pitch and other solid condensed deposits in the stand-pipes and on the covers of gas-retorts, hydraulic mains, and other conduits or receptacles for gas.

Such solid deposits, the patentee states, are formed by the tar which becomes condensed in the pipes flowing down to any point where it can collect, whereupon, owing to the temperature of the gas passing through the pipe being slightly higher than that of the tar thus collected, the latter distils off, leaving a solid residue behind. According to this invention such action is prevented by forming upon the external surfaces of the pipes, covers, hydraulic mains, and other conduits and receptacles, ribs or other projections, so as to offer considerable surface to the cooling action of the external air. By this means the pipes are cooled with sufficient rapidity to reduce the temperature of the gas passing through them to that of the tar deposited, and thus the distilling of the latter is prevented.

1889.—Molison, A. M., Swansea, "*Improvements in lighting ordinary coal gas jets by electricity.*" Provisional protection only obtained. Dated May 10, 1878.

This apparatus consists of an electric battery, a piece of platinum foil, or a piece of spongy platinum (the platinum being placed within a guard to prevent its being displaced), so arranged that, at will, the battery current may be made to pass through the platinum, the platinum conductor being so shaped that at one point the connection through which the electric current has to pass is so small that great resistance is offered, and consequently the conductor at that point gets heated. When the instrument is in use, the jet of coal gas is made to flow and impinge on the platinum conductor, which has already been heated at a point by the battery current, the effect being that the platinum is further heated (by catalysis) by the gas ultimately to whiteness, when it ignites the gas. The speciality of the invention consists in using a battery current to heat the platinum at a point, thus giving, as it were, a start to the coal gas to produce the desired effect, which otherwise it would be incapable of doing. The instrument is of various forms, and any battery may be used.

1921.—Blackwell, W., Dalton-in-Furness, "*An automatic balance pump.*" Provisional protection only obtained. Dated May 14, 1878.

In this pump an ordinary windbore (at the bottom of a pipe) is made to communicate by a valve or clack-piece with an L-bend pipe, with which again two parallel perpendicular pipes are connected, one the working pipe, in which the plunger or piston works, which opens direct into the L-bend; and the other the column or water-pipe, the connection with which is by means of a second valve or clack-piece.

1997.—Hannoversche Maschinenbau-Actien-Gesellschaft (vormals Georg Egestorff), Hanover, "*Improvements in gas-engines with two pistons.*" A communication. Patent dated May 17, 1878.

This invention relates to a gas-engine in which the motive power is produced by causing a mixture of gas and air to explode after the same has been compressed to a certain extent, such compression enhancing the power developed by a given quantity of gas, and consequently increasing the effect of the engine.

The arrangement of engine designed for utilizing the power thus produced consists of a cylinder open at both ends, in which two pistons move in contrary directions. From the upper piston of the cylinder, which is by preference placed vertically, motion is transmitted to two parallel cranks of a fly-wheel shaft, by means of a piston-rod, a cross-head, and two connecting-rods. The lower piston is directly jointed to a single connecting-rod acting on a third crank, which is arranged on the same shaft between the two cranks, but opposite to them. The pistons, therefore, recede from and approach each other simultaneously, but when they are at the shortest distance from each other they leave a space for the compressed gas and air between them. This space communicates by one channel or port with the slide-valve, which admits air and gas, and by another channel with an exhaust-valve.

The pistons at the first stroke outward—*i.e.*, when receding from each other—aspire gas and air, the admission-valve being in such a position as to open suitable communications for this purpose. The aspired gas-mixture having thereupon been compressed by the first inward stroke, is caused to be ignited, and to explode immediately after the pistons have commenced to recede from each other the second time. This ignition is effected in the following manner:—In the admission slide-valve there is a passage or chamber, which, by a perforation in the slide and a small channel in the cylinder, may communicate with the space containing the compressed gas-mixture. This communication is opened a few moments before the explosion is to take place. At the same time the chamber in the slide-valve is open on the outside towards a gas-flame constantly burning. When the valve is in this position, the pressure in the cylinder forces a jet of gas and air through the perforation into the chamber. Within the latter a tube is arranged by which the jet is directed in such a manner as to cause a draught through the chamber towards an eduction channel in the slide face of the cylinder. The gas-flame being thus sucked into the chamber of the valve, ignites the gas mixture. The valve now rises, and further transports the burning gas-mixture upward until communication is established between the chamber and the inlet port of the cylinder, whereupon explosion takes place, driving the pistons outward and developing power. At the subsequent in-stroke the combustion gases are driven out through the exhaust-valve.

The admission-valve and the exhaust-valve are actuated by a crank, or eccentric, and a cam disc respectively, which are each keyed on a shaft driven at half the number of rotations of the crank-shaft.

2028.—Bennett, P. D., Birmingham, "*Improvements in apparatus employed in the purification of coal gas.*" Patent dated May 21, 1878.

This invention has reference to improvements in centre valves, and, as applied to a centre-valve for working one, two, three, or four purifiers, is thus described in the specification:—

The valve apparatus consists essentially of three cylindrical chambers or vessels. The lower one, constituting the base of the apparatus, contains the inlet and outlet gas-mains, and also serves as a tar-well for receiving the tar and ammoniacal liquor condensed in the apparatus. The second chamber fixed upon the bottom one, contains annular troughs or lutes for forming a water valve, and the lower or fixed part of a dry valve. The third chamber or vessel, which is capable of a rotary motion, surmounts the second one, and contains the parts necessary for forming with the second chamber or vessel both a water valve and a dry valve, as hereafter more fully explained. The second vessel is divided by the water lutes and bottom dry faces into three concentric annular portions, the inner central one fitting with a socket and spigot joint into the outlet-main of the tar-well. The second annular portion is connected with the inlet gas-main, and serves as a channel for the incoming gas. The third concentric portion is divided radially into eight compartments corresponding to the inlets and outlets of the four purifiers. In each of these compartments is a tar-pipe, which carries off the tar and ammoniacal liquor into the well below. The bottoms of the lutes are connected by pipes or passages in the radial divisions, opposite which pipes or passages are plugs in the exterior, to facilitate the cleaning out of the lutes. By means of these pipes or passages, the water in all the lutes is preserved at the same level. In every case the impure gas is enclosed by the faces of the dry valve, which are surrounded by the water valve. From the bottom of the third and moveable chamber depend three concentric lute plates and radial and concentric valve faces, corresponding with the annular troughs or lutes and valve faces of the chamber below. The lute plates dipping into water in the concentric troughs of the second chamber constitute a water valve, and the valve faces of the third chamber make with the valve faces of the second chamber a dry valve. The third vessel is rotated on the lower or second one by means of a pinion and rack fitted on the third vessel. In the top of the valve which surmounts the third vessel there are only five radial divisions, and the concentric plate between the first and fifth divisions is cut away to allow the gas to enter the first purifier.

In the accompanying engravings, fig. 1 represents in elevation, and fig. 2 in vertical section, an apparatus or centre valve made according to this invention.

This is constructed in four portions, the lowest of which, marked *a*[illegible]

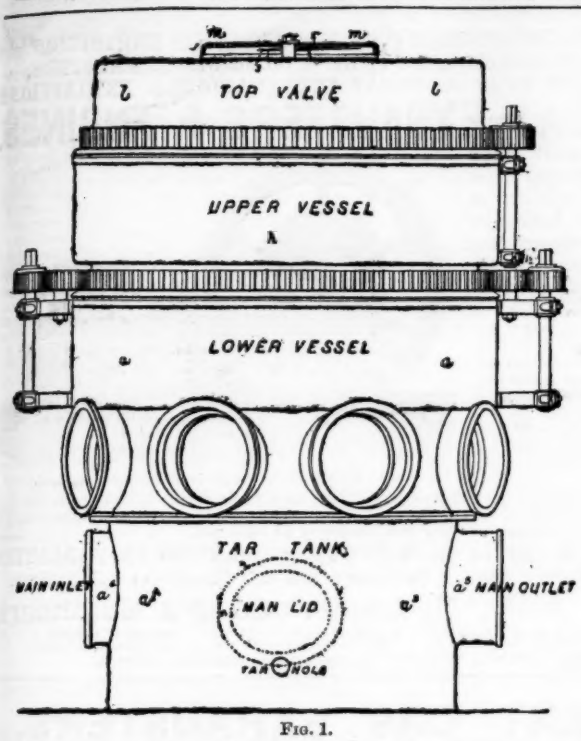


FIG. 1.

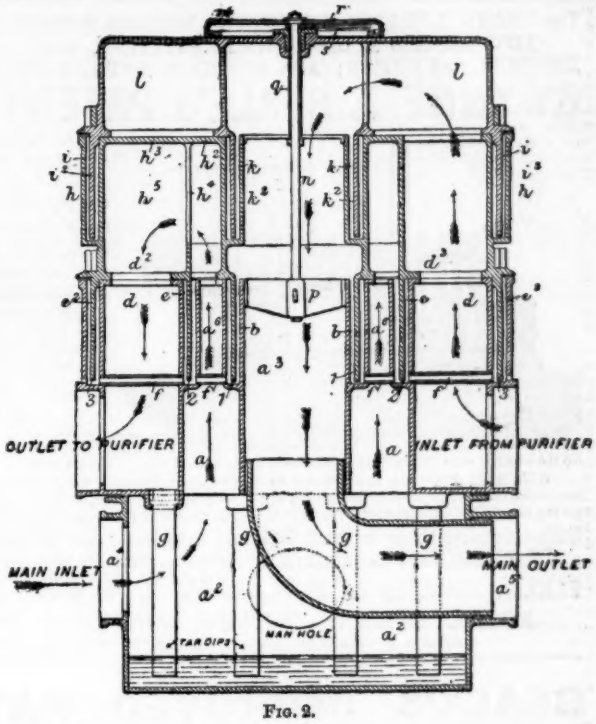


FIG. 2.

serves as a tar-tank, and contains the main inlet-pipe, a^4, and the main outlet-pipe, a^5. The second vessel, marked a, fixed upon the tar-tank, a^3 (called the lower vessel), consists of a casing containing a main outlet passage, a^2, in the centre, surrounded by a water lute, b, to prevent the foul gas in the main inlet passage, a^6, which is concentric with the water lute, b, from mixing with the purified gas escaping by the main outlet, a^5. Around the main inlet passage, a^6, of the lower vessel, a, is another concentric lute, c, and around this lute are radial divisions, d, corresponding to the inlets and outlets of the purifiers. These radial divisions are surrounded by the external water lute, c^2, which prevent the escape of gas into the air. The lutes are all joined near the bottom by radial pipes, f, by which the same water level is maintained in the three lutes, and the latter permitted to be cleaned from the exterior of the apparatus. In the bottom of each radial division of the lower vessel, a, is placed a tar-pipe, g, to convey the tar and ammoniacal liquor to the tar-tank, a^3, below, where the ends of the pipes, g, are sealed by the ammoniacal liquor.

The third portion of the valve, termed the upper vessel, is marked h, and has concentric lute plates, 1, 2, and 3, which engage in the water lutes, c, c^3, and b, of the lower vessel, a. The vessel, h, has also radial divisions, d^2, corresponding to the radial divisions, d, in the lower vessel, a, and has also inlet and outlet passages similar to those in the lower vessel, a, excepting that the main inlet passage is covered at the top, h^3, and opens at h^4 into one of the radial divisions, h^5, which also has a solid top, h^3, to prevent the escape of gas into the vessel above it (termed the top valve), marked l. Thus the gas enters by the opening, h^4, into one of the radial divisions, h^5, and descends into the corresponding division in the lower vessel, a, and thence to the first purifier to be treated in the ordinary way. On the top of the upper vessel, h, are two water lutes, i, k, one inside the main outlet, and the other around the outside of the top valve, l, which lutes, i, k, are also joined by tubes.

The top valve, l, has two concentric lute plates, i^2, k^2, working in the top lutes, i, k, of the upper vessel, h. The top valve, l, is closed at top, and has four radial divisions and an outlet passage in the centre. One of the radial compartments, into which the top valve is divided by the radial divisions, has a blank face extending over one division of the upper vessel, and an opening corresponding to the next division, and through this opening the gas passes to the main outlet, which outlet forms the centre tube of the valve, and is connected by a bend to the main outlet in the tar-tank, a^2.

An indicator dial, m, is fixed over the top valve, l, to a rod, n, which rod is cottered into a cross-piece, p, in the lower vessel, a. The dial is immoveable, and is marked with the names of the different purifiers with which the apparatus is connected, and with divisions corresponding to the centres of the inlets and outlets of the centre valve or apparatus. On the rod which carries the dial is a tube or hollow shaft, q, connected to the upper vessel, h. This tube or hollow shaft carries a finger or pointer, r, which points directly over the centre of the division from which the gas first leaves the centre valve, and enters the first inlet of the purifiers. This pointer is distinguished by the words "first inlet," and shows on the dial to which purifier the gas passes first. Another finger or pointer, s, is fixed to the top valve, and moves with it. This finger always points over the centre of the division which leads to the main outlet where the gas leaves the last purifier outlet. The finger, s, is distinguished by the words "last outlet," and the purifier outlet on the dial to which it points is the last one that is being worked.

The top valve, l, and the upper vessel, h, are moved as required by the racks and pinions on their outsides, as represented in fig. 1.

2037.—CLAYTON, S., Bradford, "*Improvements in gas motor engines and in apparatus connected therewith.*" Patent dated May 22, 1878.

This invention relates to that description of gas motor engines worked by a mixture of air and inflammable gas or vapour, which is admitted in the cylinder by means of a pump, that draws in a regulated supply of air gas, or vapour, or air gas, and air, and forces the same in the cylinder through a port regulated or controlled by a valve, and so timed as to allow of the pump drawing in the required quantity of mixture at each outward stroke of the engine piston. The supply can be compressed or be at atmospheric pressure. The supply of gas is regulated by a governor.

For this purpose on a bed or foundation plate there is fitted a cylinder, which is jacketed, and in which jacket water is allowed to circulate. Under the cylinder, and firmly bolted to it, is a pump communicating by a passage with the engine cylinder port. The engine cylinder is made longer than the pump, which allows of fixing the exhaust valve in the centre of the engine cylinder for the escape of the consumed gases, and also provides a space at the back of the piston for a new charge. When the engine piston is travelling its outward stroke, by the gradual expansion of the gases and development of heat, the pump draws in a new charge, and continues to do so until the piston reaches the end of the outward stroke, and, to prevent back pressure, the exhaust valve opens just before the piston reaches the end of the outward stroke, allowing the consumed gases or products of combustion to escape, which are forced out by the inward stroke of the engine piston, and by the fresh charge, which is forced in at the same time by the inward stroke of the pump piston. The exhaust valve is closed nearly at the end of the inward stroke when working at atmospheric pressure, but when working under compression the exhaust valve closes some time before the end of the inward stroke. The exhaust valve is worked by an eccentric or cam.

APPLICATIONS FOR LETTERS PATENT.

4755.—FOULIS, W., Glasgow, "Improvements in gas-engines." Nov. 21, 1879.

4770.—EASTON, W., and WOODALL, H., Leeds, Yorks, "Improvements in apparatus for washing or scrubbing gas." Nov. 22, 1879.

4796.—GATEHOUSE, T. E., Camberwell, London, "Improvements in electric lighting apparatus." Nov. 25, 1879.

4798.—KIRKHAM, T. N., and HERSEY, T., Westminster, "Improvements in apparatus employed in the manufacture of gas." Nov. 25, 1879.

4820.—EDMONDS, E., Fleet Street, London, "A new or improved gas motor or engine, and new arrangements of mechanism employed with the same." A communication. Nov. 25, 1879.

4857.—WRIGHT, J. F. and G. E., Birmingham, "Improvements in gas-burners for heating purposes." Nov. 27, 1879.

4901.—HEARSON, C. E., Southwark Street, London, "Improvements in gas governors or regulators." Nov. 29, 1879.

4904.—DERING, G. E., Lockleys, Herts, "Improvements in the manufacture of bricks to be used for, and in forming refractory linings for furnaces, converters, and other vessels, and in the manufacture of crucibles, tuyers, and other articles which are required to withstand high heat." Nov. 29, 1879.

4968.—SAMPSON, J., Liskeard, Cornwall, "Improvements in apparatus for preventing waste of water from cisterns and other sources, and for preventing the contamination or impregnation of water supply with foul air or gases." Dec. 4, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2154.—MILLAR, W., and DURIE, J., Manchester, "Improvements in apparatus for heating or cooling liquids or gases." May 30, 1879.

2191.—BENSON, M., Southampton Buildings, London, "Improvements in gas-engines." A communication. June 3, 1879.

2301.—WERDERMANN, R., Princes Street, London, "Improvements in apparatus for electric lighting." June 10, 1879.

2338.—CLARK, A. M., Chancery Lane, London, "Improvements in gas-burners for lighting and heating." A communication. June 12, 1879.

2391.—GOULD, R. H., Battersea Park Road, London, "Improvements in fluid-meters, parts of which improvements are also applicable to other similar purposes." June 17, 1879.

2553.—GOULD, R. H., Battersea Park Road, London, "Improvements in liquid-meters." June 25, 1879.

2569.—LONGSDON, A., Queen Victoria Street, London, "Improvements in or connected with gas-generators." A communication. June 26, 1879.

3699.—CHALOBY, M. A. L., Paris, "Improvements in apparatus for making gas for lighting and heating purposes." Sept. 15, 1879.

3750.—HADDAN, H. J., Westminster, "Improvements in electric lamps and mechanism for electric lighting." A communication. Sept. 18, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

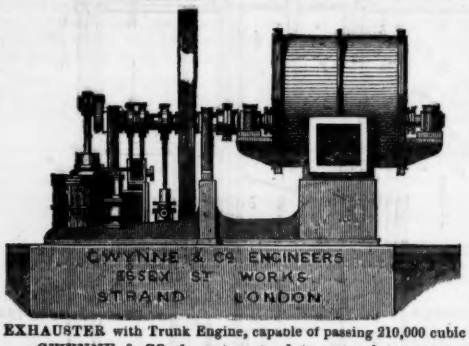
4381.—O'NEILL, A., "Improvements in modes of constructing and laying mains and service-pipes for water, gas, and other similar purposes." Nov. 11, 1876.

4386.—CLARK, A. M., "Improved apparatus and machinery for generating and utilizing a motive gas obtained from water." Nov. 11, 1876.

4422.—LAKE, W. R., "Improvements in and connected with the pistons of air and gas engines." Nov. 15, 1876.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

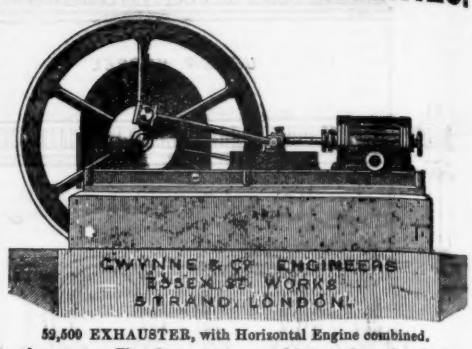
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

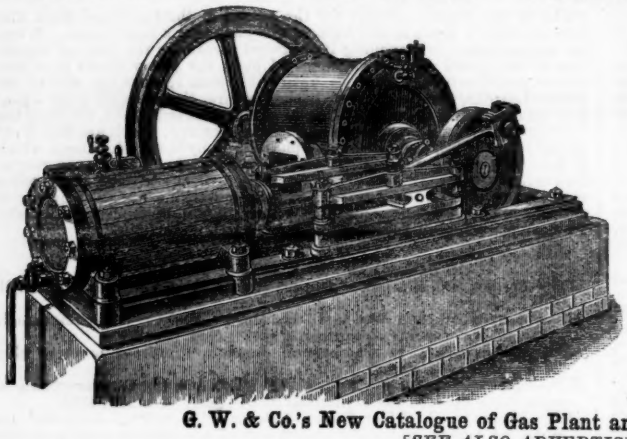
GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.**, Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,



WITH

Wrought-Iron Spindles and

ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

**MAKERS OF ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.**

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[*SEE ALSO ADVERTISEMENT, PAGE* 918.]

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.

A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, Gas and Hydraulic Engineer, CHARLES HENRY STREET, and BISSELL STREET, BIRMINGHAM.

Now Ready, Handsomely bound in Morocco gilt, cloth sides, gilt edges, Vols. 1 and 2 of

KING'S TREATISE

ON THE

SCIENCE & PRACTICE OF THE MANUFACTURE & DISTRIBUTION

OF

COAL GAS.

EDITED BY THOS. NEWBIGGING, C.E., M. INST. C.E., AND W. T. FEWTRELL, F.C.S.

VOL. I. contains 460 pages of Letterpress, and is illustrated by 521 Woodcuts and 36 page and double-page Engravings, printed on Plate paper, and a full-page COLOURED ENGRAVING of the BECKTON GAS-WORKS, forming a frontispiece to the Work.

VOL. II. contains 470 pages of Letterpress, and is illustrated by 355 Woodcuts and 28 page and double-page Engravings

Price of each Volume, 28s.

ORDERS RECEIVED BY

WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

WANTED, Readers of the NEW Edition, 1879, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

WANTED, by a respectable Married Man, a Situation as MANAGER in a small Gas-Works, or ASSISTANT MANAGER of a large Works. Thoroughly understands the Making and Distribution of Gas, Gas-Fitting, Main and Service Laying, and is a good Draughtsman. High reference; moderate salary. Aged 32. Address GEORGE DORE, RHAYADER.

TO GAS COMPANIES AND CORPORATIONS.

WANTED, by the Advertiser, a Situa- tion as SECRETARY and MANAGER of a small Gas-Works, or ASSISTANT MANAGER of a large Works. Has had every experience in a large Gas-Works. Advertiser's only reason for wishing to leave present situation is to better himself. Good references and testimonials. Address No. 606, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO PIPE LAYERS, &c.

WANTED, by the Buxton Local Board, TENDERS for Laying about 895 yards of 12-in. PIPES. Sections of the ground may be seen, and particulars and forms of tender obtained, on application to Mr. Geo. Smedley, Gas-Works, Buxton.

Tenders, endorsed "Tender for Gas-Mains," addressed to the Chairman, to be forwarded not later than the 20th inst.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSIAH TAYLOR, Clerk.

Buxton, Dec. 6, 1879.

SLEAFORD GAS COMPANY, LIMITED.

FOR SALE—Single Gasholder, 32 ft. by 14 ft., Counter-balanced. Connections and all complete, in good condition. Reason for removal, ground wanted.

Particulars to be had of HARRY WIMHURST, Manager.

PURIFIERS.

FOR SALE—Four Purifiers, as they stand at the West Ham Gas-Works, Stratford, Essex, 14 ft. by 14 ft. by 5 ft. deep (inside measure), with Wood Sieves complete. 12-in. Connections for working straight through and round again.

Ten 12-in. Valves, part Donkin's and part Wales and Robinson's make.

Wrought-Iron Girders and small Crabb to each Purifier, for lifting cover; 4-in. Air Valves; Holding-down Screws, &c., all in good working condition, having been repaired, cleaned, and made ready for use, and capable of doing a large amount of work. Bottoms are in 9 plates, sides, 4 corner plates, 2 intermediate plates; lutes cast on to side plates.

Application to be made to Mr. EDWARD H. THORMAN, Engineer, West Ham Gas-Works, STRATFORD, E.

TO BE SOLD, Cheap, Three Telescopic GASHOLDERS, two 60 ft. diameter and 20 ft. deep each lift, and one 70 ft. in diameter and 20 ft. deep. Only been in use eight years. May now be seen at work at the Effingham Street Gas-Works, Sheffield.

For price, apply to THOMAS PIGGOTT AND CO., Spring Hill, BIRMINGHAM.

TOWN COMMISSIONERS OF NEWRY.

GAS TAR.

THE Gas Committee of the Town Com- missioners will receive TENDERS for the Purchase of the Surplus TAR produced at the Gas-Works for One year from date of contract.

The contractors will have to supply their own vessels regularly, and take delivery at the Works.

Tenders to be forwarded to the undersigned.

ROBERT H. DOHERTY, Town Clerk.

Board Room, 6, Marcus Square, Newry,
Nov. 25, 1879.

DRONFIELD GASLIGHT AND COKE COMPANY.

THE Directors invite Tenders for the Purchase of the TAR produced at their Works for One year, from Jan. 1, 1880.

Tenders, stating price per ton at the Works, or delivered at Dronfield Railway Station, should be sent to the undersigned not later than the 24th inst.

The Directors do not bind themselves to accept the highest or any tender.

By order,
C. THORPE, Secretary.

Chesterfield, Dec. 2, 1879.

SPENT OXIDE.

THE Directors of the Sheppy Gas Com- pany invite TENDERS for the Purchase of about 60 Tons of SPENT OXIDE. It will be loaded free into a barge at their wharf, on the Medway, at West Minster, near Sheerness.

Terms to be cash on delivery, and the Company do not bind themselves to accept the highest or any tender.

Tenders, so marked on the outside, to be addressed to the Secretary, Company's Office, 2, Trinity Road, Sheerness-on-Sea, and be delivered on or before Dec. 20, 1879.

By order of the Directors,
A. W. MARKS, Secretary.

Company's Office, Dec. 3, 1879.

PHŒNIX GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that an EXTRAORDINARY GENERAL MEETING of the Proprietors of this Company (holding, previous to the 17th of September last, £300 and upwards in shares or stocks) will be held at the Bridge House Hotel, Southwark, on Wednesday, Dec. 17, 1879, at Two o'clock precisely, to consider a scheme, now pending before the Board of Trade, for the Amalgamation of this Company and the South Metropolitan Gas Company, which scheme will then be submitted to the Proprietors present in person or by proxy for their approval, and to pass such resolutions in respect to the measure as the said meeting may determine.

And notice is also given that immediately after such meeting a further Extraordinary General Meeting will be held, to consider a Bill to be submitted to Parliament enabling the Company to acquire more land and create further capital, and for other purposes; and to pass such resolutions in respect to the same as the said meeting may determine.

By order of the Court of Directors,
I. A. CROOKENDEN, Secretary.

70, Bankside, London, S.E., Nov. 26, 1879.

STOCK OF THE BRISTOL UNITED GASLIGHT COMPANY.

MESSRS. H. R. FARGUS & CO. will Sell by Auction, in pursuance and under the provisions of the Bristol United Gaslight Company's Act, 1873, at their Sale Room, Clare Street, in the city of Bristol, on Friday, Dec. 19, 1879, at Two o'clock precisely, £15,000 CAPITAL STOCK, issued by them under the authority of the above-named Act.

The Stock will be sold in lots of £100 each.

For conditions of sale and any further particulars, apply to the Auctioneers, Clare Street, Bristol; to the Secretary of the Company, Canon's Marsh, Bristol; or to Messrs. BRITTANS, LIVETT, and MILLER, Solicitors, Albion Chambers, BRISTOL.

THE Gas Committee of the Leeds Cor- poration require TENDERS for the Supply of 600 D-RETORTS (all Mouthpieces), 20 in. by 14 in. by 6 ft., to be delivered at their several Works within four months of order.

Sample pieces of above dimensions (paid for) to be forwarded to Gas-Works, Meadow Lane, not later than the 13th of January.

Templates can be had on application to Mr. H. Woodall.

Tenders, at per foot, addressed to the CHAIRMAN, Gas Office, Boar Lane, to be sent in not later than the 14th of January.

RAMSGATE IMPROVEMENT COMMISSIONERS.

THE Gas and Water Committee invite TENDERS for the Purchase of the Surplus TAR made at their Works from Jan. 1, 1880, for One or Two years. Coals carbonized annually, about 8000 tons. The Tar will be delivered to the Contractor at the Gas-Works. Tenders to state price per gallon.

Offers to be sent in not later than Wednesday, Dec. 17, addressed to the Chairman of the Gas and Water Committee, Ramsgate.

The Corporation do not bind themselves to accept the highest or any tender.

Further particulars on application to
WILLIAM A. VALON, Engineer and Manager.

BOROUGH OF BARROW-IN-FURNESS—GAS AND WATER DEPARTMENT.

THE Corporation are prepared to receive TENDERS for the Supply of GENERAL STORES required in the Gas and Water Department for the year 1880, comprising: Foundry Work, Wrought-Iron Tubes, Oils, Paints, Ironmongery, Fire-Clay Goods, Meters, &c.

Sealed tenders (on forms to be obtained from Mr. W. Fergusson, Manager of the Gas-Works), addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Stores," to be delivered at the Town Clerk's Office on or before Dec. 16, 1879.

The lowest or any tender not necessarily accepted.

By order,
C. F. PRESTON, Town Clerk.

Town Clerk's Office, Barrow-in-Furness, Nov. 28, 1879.

BOROUGH OF ROTHERHAM GAS-WORKS.

GAS PLANT FOR SALE.

THE Gas Committee of the Rotherham Corporation invite TENDERS for any of the following:—

One Station-Meter, in ornamental square case, 6 ft. 6 in. by 6 ft. 6 in., made by West and Gregson; Inlet and Outlet 8 in.; Hydraulic Valves and one Bye-Pass; to pass 8000 feet per hour.

One 8-in. District Governor, to pass 8000 feet per hour.

Condensers with 12-in. Connections, to pass 16,000 feet per hour.

One Set of four Purifiers, 10 ft. by 10 ft. by 3 ft. 6 in. deep; 12-in. Connections, Hydraulic Valve, and Lifting Apparatus complete.

12 Lengths of Hydraulic Main, 16 in. by 16 in. by 10 ft. 6 in.

30 D Mouthpieces, 23 in. by 15 in.
31 D Mouthpieces, 21 in. by 14 in.
86 H Pipes, 4 in. inside diameter.

The above may be inspected and further information may be obtained on application to Mr. Jas. Goodwin, Manager of the Works.

Endorsed tenders to be sent in to me not later than Dec. 20, 1879.

By order,
G. W. HODGKINSON, Town Clerk.

Council Hall, Dec. 5, 1879.

PARISHES AND DISTRICTS ADOPTING THE AVERAGE METER SYSTEM.

NOTICE is hereby given that owing to a reduction having been determined upon, with the concurrence of the Gas Referees, in the number of meters per lamp, the Lighting Committee of the Vestry of St. Pancras have for Disposal 100 Cast-Iron Meter Boxes, 100 Cast-Iron Cased Compensating Meters of the most improved construction, with a capacity of 12 cubic feet of gas per hour, and with a drum equal in diameter to that of an ordinary five-light meter; and also 100 complete Sets of Connections. The whole of the above articles are in a serviceable condition, and were manufactured by Messrs. Parkinson and Co., of City Road, London. This offers a favourable opportunity to any parish or district about to adopt the advantages of the meter system to the lighting of the public lamps.

By order,
(Signed) T. W. ECCLESTON GIBB, Vestry Clerk.

TO PIPE FOUNDERS.

THE Gas Committee of the Corporation of the Borough of Newbury are prepared to receive TENDERS for the following PIPES, delivered at the Newbury Station of the Great Western Railway, carriage paid, viz.:—

800 yards of 4-in. Socket and Spigot Pipes.
600 „ 5-in. „ „ „
500 „ 6-in. „ „ „

All Pipes to be coated with Dr. Smith's solution.

Tenders, duly sealed and endorsed "Tender for Gas-Mains," must be delivered at my Office on or before Thursday, Dec. 18 inst.

The Gas Committee do not bind themselves to accept the lowest or any tender.

(Signed) H. BURKE GODWIN, Town Clerk.

Office, Northbrook Street, Newbury,
Berks, Dec. 8, 1879.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Plymouth and Stonehouse Gaslight and Coke Company are prepared to receive TENDERS for the Purchase of the Surplus TAR produced at their Works for One or Three years from Jan. 1st, 1880. A separate quotation should be named for each of the aforesaid periods.

The Company will deliver the Tar through their main into the Contractor's vessels at the Creek, Sutton Pool, or into his carts on their Works free.

Payments to be made in cash monthly. The Directors may require the Contractor to give security for the faithful performance of his contract.

Further particulars can be obtained on application to the Secretary, at the Company's Offices, 1, Athenæum Terrace, Plymouth, to whom sealed tenders, endorsed "Tender for Tar," are to be sent on or before Wednesday, Dec. 17, next.

The Directors do not bind themselves to accept the highest or any tender.

By order,
JOHN THOMAS, Secretary.

Gas Offices, 1, Athenæum Terrace,
Plymouth, Nov. 22, 1879.

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—

110 Mouthpieces, D-shape, 13 in. by 22 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. 28 Mouthpieces, D-shape, 16 in. by 20 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12 in. Slide-Valves and 12 in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12 in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair Mitre Wheels.

Set of four Purifiers, 12 ft. by 12 ft. by 4 ft., with 12-in. Centre-Valve (Cockeys), and Connections and Lift complete.

Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

Two 12-in. Governors, by Wright, London, with 12-in Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

GAS LIGHTING IMPROVEMENTS.

GEO. BRAY & CO.'S
NEW PATENT LANTERNS.

See Page 914.

GAS COAL.

THE Tawd Vale Colliery Company, Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete analysis on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.

Mr. James Paterson, C.E., F.G.S., in his analysis of T. V. Arley Coal, says: "Some parts merge into a semi-Cannel; Gas per ton, 10,300 cubic feet; illuminating power, 16·96 candles; coke of high quality, 1431 lbs. per ton."

Collieries, Skelmersdale, near Ormskirk; Offices, 5, New Hall, Old Hall Street, LIVERPOOL.

Now ready, Second Edition, price 7s., by post 7s. 3d., the

GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, M.I.C.E.

Orders to be sent to

WALTER KING,
11, BOLT COURT, FLEET STREET, LONDON, E.C.

THE
IMPERIAL METER CO.,
LIMITED,
Makers of THE IMPROVED DRY GAS-METERS, THE PATENT WET GAS-METERS, Special Meters for Public Lighting, STATION-METERS, Governors, &c.
KING'S ROAD, ST. PANCRAS,
Formerly also (Walter Ford) at Gray's Inn Road.

G. E. TOURNAY,
RETORT-SETTER,
CONTRACTOR FOR THE ERECTION
OF
Chimney Shafts, Retort Ovens, &c.,
ST. MARY'S STREET, WINCHEAP,
CANTERBURY.

First-Class Testimonials.

Less Heat, No Smoke,

White Light, & Economy.

SPECKSTEIN & LAVA
Gas-Burner Fabricants
On the most approved French and German principles.
These Burners can be made to consume from 1¼ feet to 20 feet of gas per hour, and to give a light from 4 to 150 candle power.
Terms and Discount on application.
Catalogue, 6d. Sample Burner, 1s.
AUGUSTUS WESTWOOD & Co.,
COMMERCIAL CHAMBERS,
WEST BROMWICH.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in th Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,
COTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.
Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

TO GAS COMPANIES.
GEORGE McKAIG,
MANUFACTURER OF
GAS-PURIFYING WOOD SIEVES,
153, CLEVELAND STREET,
DONCASTER.

It requires but one trial to prove the Superior Make, Strength, and Durability of these Sieves.

CARRIAGE PAID.

J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,
RETORT-SETTING—A SPÉCIALITÉ.
ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.
ESTIMATES GIVEN FOR MAIN-LAYING.
N.B.—All kinds of Fire Goods and Gas Apparatus supplied on the shortest notice.
Address:—J. & H. ROBUS, BELL GREEN, CATFORD, LONDON, S.E.

HYDRATED PURIFYING MATERIAL.
Samples on application.

MESSRS. SPENCE BROS., LIMITED,
Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.
PRICES ON APPLICATION.
ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.
VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

THE FARNLEY IRON COMPANY, LIMITED,
FARNLEY, near LEEDS,
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS & FIRE-BRICKS
Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.
In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.
London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.
" " Glazed Bricks: A. BARFIELD, 22, Great George Street, Westminster.

LIVESEY FIRE-CLAY WORKS.
NEAR BLACKBURN, LANCASHIRE.
(ESTABLISHED 1835.)
ORLANDO BROTHERS, LIMITED,
MANUFACTURERS OF PATENT CLAY RETORTS,
AND EVERY DESCRIPTION OF
TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.
FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

ROBT. DEMPSTER & SONS,
GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,
ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS;
CONTRACTORS FOR THE
ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

WILLIAM SUGG'S
IMPROVED SYSTEM OF STREET LIGHTING,

SUITABLE FOR EITHER COMMON OR CANNEL GAS.

Results obtained in Illuminating Power from WILLIAM SUGG'S 200-candle Burners with Cannel and Common Gas:—

Variety of Gas.	Cubic Feet of Gas burnt per Hour.	Illuminating Power in Sperm Candles burning 120 Grains per Hour.	Number of Candles to which every Cubic Foot of Gas burnt is equivalent.
Common 16-candle	53·4	228	4·25
Cannel 19-candle .	47·3	252	4·76

Joint experiment by—

CHARLES HEISCH, Superintending Gas Examiner to the Corporation of London.

T. N. KIRKHAM, M.I.C.E., F.C.S.

C. MEYMOTT TIDY, M.A., M.B., Professor of Chemistry and of Forensic Medicine at the London Hospital, Medical Officer of Health for Islington, and late Deputy Medical Officer of Health for the City of London.

The Illuminating power of the gas made by this Company, on the 9th inst., was 22·7 standard sperm candles for a consumption of 5 cubic feet per hour, in a Sugg's No. 7 steatite bat's-wing burner. On the same day the following results were obtained from two of Sugg's large new Argand burners:—

FIRST EXPERIMENT.

Burner: Sugg's Argand, with two concentric flames.

Consumption per hour . . . . . 22·2 cubic feet.
Illuminating power . . . . . 103·7 candles.
or 4·67 candles per foot of gas.

SECOND EXPERIMENT.

Burner: Sugg's Argand, with three concentric flames.

Consumption per hour . . . . . 40·8 cubic feet.
Illuminating power. . . . . 208·8 candles.
or 5·12 candles per foot of gas.

I have reason to believe that these are as high, if not the highest results yet obtained per foot of gas from these burners.

(Signed) WILLIAM KING,
Liverpool United Gaslight Company,
Liverpool, April 16, 1879. Engineer's Office, Duke Street.

[See JOURNAL OF GAS LIGHTING, April 22, 1879.]

Sugg's 200-candle burner, with 42·09 cubic feet of 20·85-candle gas, gave an illuminating power of 231·56 candles.

Same quality of gas as used at Westminster Bridge, and Waterloo Place, Regent Street.

(Signed) A. C. M'MINN,
Engineer to The Gaslight and Coke Company,
June 16, 1879. Kensal Green Station.

SUGG'S ARGAND, WITH THREE CONCENTRIC RINGS.

Illuminating Power of Gas.	Standard of Comparison.	Gas Consumed per Hour.	Illuminating Power.	Illuminating Power per Cubic Foot.
		Cubic Feet.		
21 candles .	5-ft. London burner . .	45	220·5	4·9
		43	210·0	4·88

(Signed) J. R. FRITH,
Engineer, Runcorn Gas Company.

The following have been selected from a number of similar letters recently received:—

Reading, Nov. 12, 1879.

Your 200-candle Burner with Shadowless Lamp, erected here some months since, in the centre of four cross-roads, continues to give the greatest satisfaction, both to the public authorities and to this Company.

Before the Lamp was erected, several tests were made as to the real cost per hour (once in the presence of the Medical Officer of Health, Dr. Shea, who is the Gas Examiner for Reading), and from an average of these tests, we found that the best rate of consumption was at 52 feet per hour, and we had not the slightest reason to doubt that the Burner gave considerably over 200-candle power. I need scarcely refer to the beauty of the light, and while such street lighting can be effected at so small a cost, there is not much fear of electricity taking its place.

(Signed) EDWARD BAKER,
Engineer and Manager,
Reading Gas Company.

Dublin, Oct. 31, 1879.

In reply to your inquiry, I beg to say that your new reflecting Street-Lamps, which we have erected in Sackville Street, are giving the greatest satisfaction. They are greatly admired not alone for their beauty, but also in consequence of the Argand burner emitting a soft light, which is reflected with an entire absence of shadow. I have calculated that each of these lamps gives as much light as eight of the ordinary Street-Lamps.

(Signed) W. F. COTTON,
Secretary and Manager,
Dublin Alliance Gas Company.

Salford, Oct. 28, 1879.

In answer to your inquiry, I may state that we have three of your large Burners and Lanterns in use in Salford, each of which consumes 48 feet of gas per hour, and yields a light equal to 230 sperm candles. This is equal to 4·9 candles for every foot of gas consumed, *a larger amount of light than yielded by any other Burner.* An important point is that the Lanterns are so constructed that there is an entire absence of shadow.

(Signed) SAMUEL HUNTER, Assoc. I.C.E.
Engineer and Manager,
Salford Corporation Gas-Works.

Keighley, Oct. 31, 1879.

Our Committee being desirous of lighting certain positions in the town in a more effectual manner, requested me to fix one of your 200-candle Burners and improved Lanterns . . . . the object being to test the relative efficiency of different systems. The lamps were erected a few weeks since, when yours conveyed at once more favourable impressions. . . . Since that I have made a number of tests, and the favourable impressions yours made have been more than realized.

I may say that our Committee are so satisfied with your system that they have decided, when such lights are required, to adopt yours.

(Signed) JOHN LAYCOCK,
Engineer and Manager,
Keighley Gas-Works.

Blackburn, Nov. 27, 1879.

I have much pleasure in saying that for brilliancy and style I have never seen anything to equal your lamps. We have twelve 50-candle burners, two 80-candle, and one 200-candle in use, and after the Lamp Committee had inspected them, they were so highly pleased that they have resolved to erect similar lamps in all the public squares and crossings.

(Signed) S. R. OGDEN,
Engineer and Manager,
Blackburn Corporation Gas-Works.

PRICES AND PARTICULARS ON APPLICATION TO

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, WESTMINSTER, S.W.

C. & W. WALKER'S
WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ESTABLISHED IN 1860.
BENJAMIN CARPENTER,
THE ORIGINAL MANUFACTURER OF THE IMPROVED
WOOD SIEVES
FOR
GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

The Dunston Engine Works Co.,
GATESHEAD-UPON-TYNE.
Are the Sole Manufacturers of
Archer's Patent Hoists,
ALSO OF
Archer's Patent Stone Breaker,
AND OF
Archer's Patent Ore Crusher & Pulveriser,
The last-named Machine (without the Pulveriser) makes the best and most durable Coke Breaker.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

ASBESTOS,
INDESTRUCTIBLE FUEL FOR GAS-FIRES.

REDUCTION IN PRICES.

Apply for Price List and Samples to the Original Manufacturer,

THOS. REYNOLDS,
100, ASTON ROAD, BIRMINGHAM.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,
SHEAF AND SPRING WORKS,
SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS,
STEEL OF ALL DESCRIPTIONS,
SCREW STOCKS, TAPS, AND DIES, SPANNERS, RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

GEORGE ORME & CO.,
ATLAS METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
STATION-METERS, GOVERNORS,
PRESSURE AND EXHAUST REGISTERS,
LAMP-METERS IN CAST-IRON BOXES,
And every Description of Gas Apparatus.

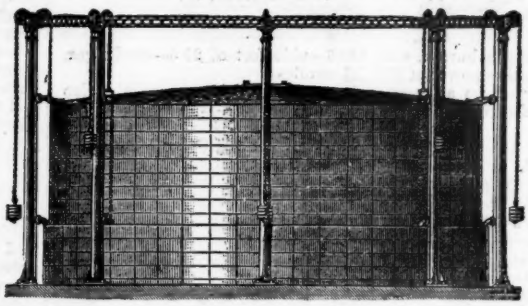
JOHN HALL AND CO., STOURBRIDGE,
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

LONDONDERRY GAS COALS
DIRECT FROM THE
MARQUESS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
For Prices and Particulars, apply to
MR. S. J. DITCHFIELD,
LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.
London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

JAMES MILNE & SON,
GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
EDINBURGH, AND
2, KING EDWARD STREET,
NEWGATE STREET, LONDON.

STATION-METERS GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,
And every description of Gas-Fittings and Gas Apparatus.



J. T. B. PORTER & CO.,
GAS ENGINEERS & MANUFACTURERS,
IRONFOUNDERS AND CONTRACTORS,
GOWTS BRIDGE WORKS,
LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

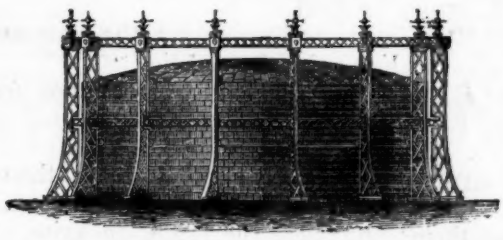
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

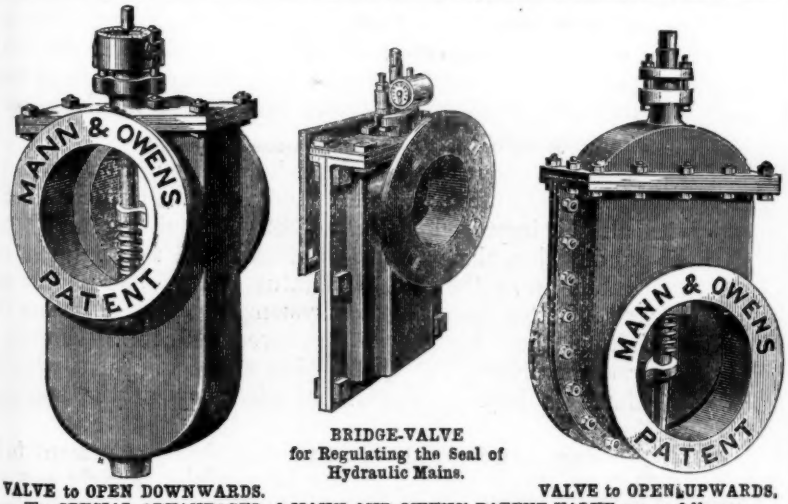
HYDRAULIC, GAS, AND GENERAL ENGINEERS,

WHITEFRIARS STREET, LONDON, E.C.

Sole Manufacturers of MANN & OWENS'

PATENT SCREW & CAM GAS-VALVE,

Protected by Royal Letters Patent in England, France, Belgium, & the United States of America.



BRIDGE-VALVE
for Regulating the Seal of
Hydraulic Mains.

VALVE to OPEN DOWNWARDS. VALVE to OPEN UPWARDS.

The SPECIAL ADVANTAGES of MANN AND OWENS' PATENT VALVE are as follows:—

1. Its non-liability to become set fast through varying temperature or from the deposit from crude gas. 2. It is made absolutely gas-tight by the simple action of a screw and cam. 3. Inconvenience through the breakage of springs or wedges setting fast cannot arise. 4. The face of the Valve is scraped and cleaned of any solid matter at each operation of opening or closing.

The Valve can be had to work either in a Vertical or Horizontal position.

Every Valve is carefully tested under pressure, and warranted perfectly sound and gas-tight.

INSTRUCTIONS FOR ORDERING.

State whether required for above or below ground, if Double Flange or Socket and Spigot Valves are wanted, or with loose Flanged Socket and Spigot pieces.

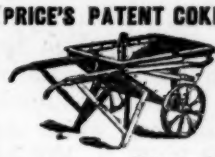
The Prices include Indicators to show extent to which Valve is open.

Also makers of PILLAR-VALVES, SELF-ACTING BYE-PASS VALVES, OUTSIDE RACK AND PINION VALVES, HYDRAULIC-MAIN VALVES, DISC-VALVES, &c.

Every description of Pumping Apparatus, Hydraulic Lifts, &c., suitable for use in Gas-Works, made to order.

PRICES, SIZES, AND FULL PARTICULARS, WITH COMPLETE ILLUSTRATED CATALOGUE, FURNISHED ON APPLICATION.

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

JAMES NEWTON & SONS,

(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

SOUTHWARK, LONDON, S.E.,

DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

TORBAY AND DART PAINT COMPANY, LIMITED.

WORKS:

DARTMOUTH & BRIXHAM (TORBAY) DEVON.

OFFICES:

23, GREAT GEORGE STREET, WESTMINSTER LONDON, S.W.

SOLE PROPRIETORS AND MANUFACTURERS OF

WOLSTON'S CELEBRATED

TORBAY IRON PAINTS.

TRADE MARK

These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead Colour.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

READY-MIXED PAINTS.

A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

Prices and Testimonials on application.

NOTICE.—With regard to an advertisement, having reference to Street-Lamps and Burners of large lighting power, which appeared in this JOURNAL of Nov. 4, and some time previous, containing the statement that "comparative experiments . . . . conclusively prove that the 'Sugg' burners give over 30 per cent. of illuminating power more than can be obtained from any other burners with the like quantity of gas," which statement purports to be based on a report given by Messrs. C. Meymott Tidy, M.A., M.B., T. N. Kirkham, M.I.C.E., F.C.S., and Charles Heisch, F.C.S., and there being only two Makers in the market, besides Mr. Sugg, of burners and lanterns of large lighting power, one of whom is ourselves, we think it right to state that, having written to these gentlemen asking for a copy of their report, they reply that they are unable to furnish us with one, as it was a private one of Mr. Sugg's, and two of the gentlemen inform us that **not only were our burners not mentioned in the report, but that they were not even tested.**

The names of the above eminent scientists being made responsible for the statement here quoted gives it an importance it would not otherwise possess; hence the above notice.

We may also state that the report of the Committee of the British Association formed to inquire as to "The Best Means for the Development of Light from Coal Gas of Different Qualities," comprising Dr. Wm. Wallace, Professor Dittmar, and Mr. Thos. Wills, F.C.S., F.I.C.E., showed that **Bray's Burners yielded the greatest amount of light,** of all the two or three score burners reported upon (which included all burners of repute in the market), and had the fewest defects—such as "smokes," "blows," &c.—recorded against them; and were the lowest in price. The report was presented at the meeting in 1878, and was the most exhaustive ever prepared on the subject.

STREET-LIGHTING IMPROVEMENTS.

BRAY'S

PATENT LANTERNS & FLAT-FLAME BURNERS

Of 30 to 200 CANDLES POWER.

This Apparatus has the following merits, viz.:—

The Burners are of the flat-flame type, which is the only practicable type for Street-Lighting purposes.

Their lighting power is greatly in excess of Flat-Flame Burners made prior to the introduction of these, and, the up and down light being taken into account, it is in excess of that yielded by any Burners, Flat-Flame or otherwise.

The flame in the lantern is remarkable for its steadiness, whiteness, and brilliancy.

The lantern is storm-proof, its efficiency not being materially affected in a gale of wind.

It is practically shadowless, though the top light is allowed to pass freely to the upper parts of buildings, instead of being reflected, in the main, round the base of the lamp, as in some systems.

These Lamps were first exhibited in connection with the Leeds Gas Exhibition, in front of the Town Hall, in conjunction with all the improved systems of Street Lighting now before the public, when the opinions expressed by Gas Engineers and the Public were that this apparatus yielded more light and diffused it better than the other systems there tried. Since this Exhibition they have been improved in several important features, the principal of these being an arrangement whereby the flame is kept in a state of efficiency in the stormiest weather.

So long as we could see any desirable improvement to be effected, we have avoided, as far as possible, sending out our lanterns, or making any public announcement regarding them. We now feel convinced that our apparatus is nearer perfection than any in the market, and offer it with complete confidence.

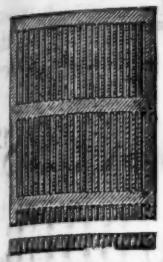
Price and Particulars on application to

GEO. BRAY & CO.,

GAS-LAMP & "ENAMEL" BURNER MANUFACTURERS,

LEEDS.

R. DEMPSTER AND SON'S



WOOD SIEVES FOR PURIFIERS,

WITH TAPER OR PARALLEL BARS,

MADE BY SPECIAL MACHINERY.

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

Prices on application. References to First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, Near HALIFAX.

London Offices: 2, SUFFOLK LANE, CANNON STREET, E.C.

GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT GAS-BURNERS

FOR

STREET LIGHTING, &c., WHICH REQUIRE NO GLASS CHIMNEY.

Speaking of these burners, erected on the Thames Embankment, the Governor of The Gaslight and Coke Company, at the half-yearly meeting, Aug. 15, 1879, says:

"Any gentleman who may wish to see the light, may do so at the foot of Westminster Bridge, where it is in direct contiguity with the electric light, so that he will be able to judge for himself. There is a light there that completely excels the electric light in the intensity of its illumination, and in the scope of its diffusion. The lamps on Westminster Bridge are some of Mr. Wigham's."

SOLE MANUFACTURERS:

J. EDMUNDSON & CO., GAS ENGINEERS,

19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

J. & J. BRADDOCK,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY CONSUMERS GAS-METERS,

OF THE HIGHEST EXCELLENCE ONLY;

ROUND STATION-METERS,

ON CAST-IRON STANDS;

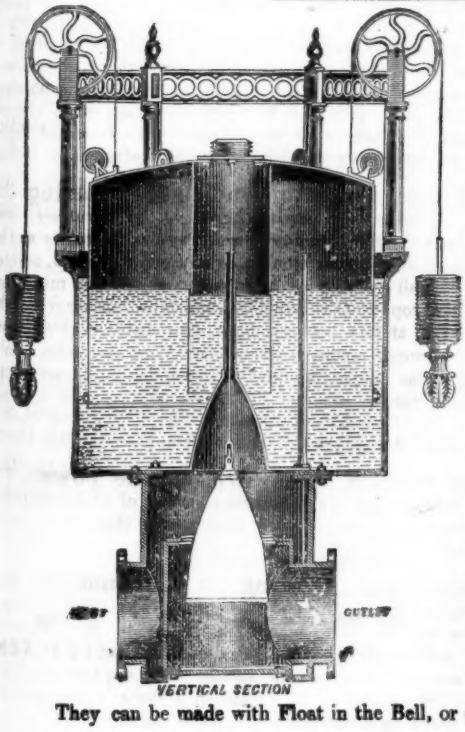
SQUARE STATION-METERS,

WITH PLANED JOINTS.

Messrs. Braddock beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

HENRY LYON,

MECHANICAL AND CONSULTING GAS ENGINEER,

NORWOOD, NORTHENDEN ROAD,

SALE, NEAR MANCHESTER.

SANDELL AND SON,

PUBLIC ACCOUNTANTS,

2, GREAT GEORGE STREET, WESTMINSTER.

Sandell and Son having been engaged during the last 25 years in Gas Companies Accounts, either in Preparing or Investigating Statements for Parliamentary Applications, Arbitrations, and otherwise, offer with confidence their Services for similar purposes.

Mr. ROBERT DEMPSTER,

CONSULTING GAS ENGINEER,

ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

Established 1836.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. Silver Medal, Paris, 1878.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.

Post orders or cheques to be made payable to F. Sutton and Co., Manufacturing Chemists, Norwich, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B., GLASGOW.

Prices on application.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.